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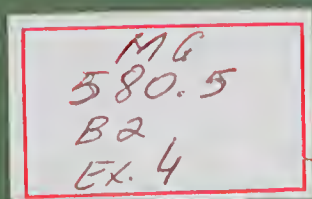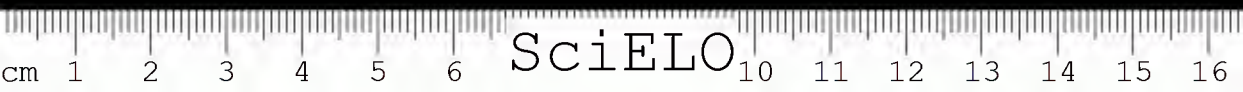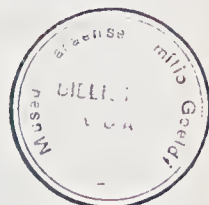
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The *Boletim do Museu Paraense de História Natural e Ethnographia* was founded in 1894, by Emílio Goeldi, and the first volume was issued in 1896. The present *Boletim do Museu Paraense Emílio Goeldi* is the successor to this publication.

CAR1BÉ

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NOTAS COMPLEMENTARES À DESCRIÇÃO DE *Sclerolobium reticulosum* DWYER, UMA NOVA OCORRÊNCIA PARA O ESTADO DO PARÁ

Maria da Graça Albuquerque Lobo[1]

RESUMO — O trabalho apresenta uma complementação à descrição de Sclerolobium reticulosum Dwyer; *com desenhos da espécie, dando ênfase às estrututuras florais. A espécie é aqui citada pela primeira vez para o Estado do Pará, sendo que antes era assinalada apenas para a Amazônia venezuelana e Estado do Amazonas (Brasil).*

PALAVRAS—CHAVE: *Sclerolobium*, Leguminosae-Caesalpinioideae, Taxonomia.

ABSTRACT — This paper offers a complement to the description of Sclerolobium reticulosum *Dwyer, along with drawings of the species; special emphasis is given to its floristic strutures. This species is now cited for the first time in the State of Pará, whereas before it had been referred to just for the Venezuelan Amazon and for the State of Amazonas (Brazil).*

KEY WORDS: *Sclerolobium*, Leguminosae—Caesalpinioideae, Taxonomy.

INTRODUÇÃO

A contribuição que ora apresentamos visa complementar a diagnose da espécie *Sclerolobium reticulosum* Dwyer (l.c.), publicada por Dwyer (1957) que, por falta de material florífero, não a descreveu por completo. Como recentemente obtivemos material coletado em uma de nossas excursões no Estado do Pará, o qual estava sem identificação específica, verificamos a literatura especializada, conjuntamente com o exame do material, chegando à conclusão de que se trata da espécie acima citada.

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Achamos por bem complementar o trabalho de Dwyer, apresentando outros detalhes como desenhos florais, os quais não constam da descrição original, contribuindo para uma melhor identificação da espécie, principalmente nos trabalhos de inventário florestal e em uma eventual revisão do gênero (que engloba as espécies conhecidas vulgarmente como "Tachi").

RESULTADO

Sclerolobium reticulosum Dwyer, Lloydia, 20(2):98, 1957. (Figuras 1, 2).

Árvore de 28 m de altura; ramos pubescentes, estriados, folhas compostas, alternas, paripenadas, acima de 9 cm de comprimento; pecíolo 2,0 — 3,5 cm de comprimento, puberulento, canaliculado em ambos os lados; pecíolulo 1,0 — 2,0 mm de comprimento, puberulento; estípula 1,9 mm de comprimento. Folíolos 5 a 9 jugos; limbo 2,0 — 10,0 cm de comprimento, 0,8 — 2,8 cm de largura, assimétrico, coriáceo, oblongo—lanceolado, ápice acuminado, base obtusa, face adaxial glabra e glabrescente e abaxial puberulenta a glabrescente, principalmente nas nervuras principal e secundárias; superfície reticulada. Nervuras secundárias, 10 — 13 pares, conspícuas na face abaxial. Inflorescência, racemo; flores pequenas, amarelas, ca. de 3,5 mm; pedicelo 1,0 — 2,0 mm de comprimento, puberulento; hipanto 0,5 — 1,0 mm de comprimento, puberulento; sépalas (5), de 1,1 — 1,8 mm de comprimento, 1,0 — 1,9 mm de largura, obovadas a suborbiculares, glabras a glabrescentes internamente e puberulentas externamente na base; pétalas (5) de 1,1 — 1,5 mm de comprimento, 0,3 — 0,8 mm de largura, ligeiramente unguiculadas, glabras externamente e internamente com pêlos brilhosos acima de 0,3 mm comprimento, esparsos na base. Estames, 10, alturas diferentes; filete filiforme subulado, 2,0 — 3,8 mm de comprimento; com pêlos brilhosos na parte interna (em 2/3 do filete); antera globosa, menor que 0,5 mm. Ovário, 1,5 mm de comprimento, piloso somente nas partes ventral e dorsal, 6 — 7 óvulos; estípite, 1,1 — 1,5 mm de comprimento, glabro; fruto não visto.

MATERIAL EXAMINADO: Brasil, Pará, Santarém; margem direita do rio Curuauna, Reserva Florestal do Curuauna (SUDAM), localidade Barreirinha; *Carlos Rosário & Mário R. dos Santos*, 832, 10/08/88 (MG, no. 131.001).

Sclerolobium reticulosum estava antes assinalada apenas para a Amazônia venezuelana e Estado do Amazonas. Portanto, este é o primeiro registro de sua ocorrência para o Estado do Pará.

AGRADECIMENTOS

Ao Sr. Carlos Rosário, pela amostra do material botânico; ao colega Ricardo Secco, pelas críticas e sugestões e a Suely Anderson, pela ajuda na elaboração do Abstract.

REFERÊNCIA BIBLIOGRÁFICA

DWYER, J.D. 1957. The Tropical American Genus *Sclerolobium* Vogel (Caesalpiniaceae). *Lloydia*, 20(2):67—118.

Recebido em 29.06.89
Aprovado em 17.05.90

Figura 1 — A- Ramo Florífero, B- Flor.

Figura 2 — Peças Florais. A- Sépalas, B- Pétalas, C- Estame, D- Gineceu, E- Estípula.

CARIBE

CDD: 581.69

THE VIRGIN FIELD IN PSYCHOACTIVE PLANT RESEARCH

Richard Evans Schultes, Ph.D., FMLS[1]

> "Peoples whom we have chosen to consider members of less-advanced societies have consistently looked to the Plant Kingdom...for the betterment of life. Should we as chemists, pharmacologists and botanists--with so many and varied means at our disposal--not take a lesson from them?" Schultes and Swain (1976).

I.

During the last half century, scientific interest in psychoactive plants has steadily grown. There is, however, much still to be learned. A number of hallucinogenic plants reported to be employed in distant primitive societies deserve further chemical and pharmacological investigation. These plants--many of them reported in reliable literature--find their major uses in magico-religious or cultural contexts amongst aboriginal groups. There are, furthermore, some that still need additional botanical study, and there exist others known only from local Indian names and which are awaiting botanical identification. There are many more, however, that have never been chemically analyzed.

Modern medicine has found therapeutic or experimental uses for some of the psychoactive principles or for semi-synthetic analogues of them whic are now valued in western medicine for a variety of applications.

Relatively new additions from plants employed in North American ethnobotany are: the hypotensive Veratrum alkaloids of northeastern United States and podophyllotoxin, a resin from the May Apple, now employed for the removal of uterine warts but known to the Penobscot Indians of Maine who employed the resin for removal of common warts (Schultes 1987).

It is always advantageous to consider what exactly are the psychoactive drugs, how they are employed amongst primitive societies that discovered their properties; where they occur in the Plant Kingdom; their diversity of biological effects; their bioactive chemical properties and their classification.

In the following pages, I shall discuss primarily those psychoactive plants that are for one reason or other still in need of scientific study. A large number of major hallucinogenic species have been relatively well studied botanically,

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anthropologically, chemically or pharmacologically. Those not considered may be consulted in Schultes & Hofmann (1980). *The Botany and Chemistry of Hallucinogens.*

II

If a plant has any physiological effect on the body, it indicates that it has at least one bioactive chemical. We should know of this chemical: it may not be used in our pharmacopoeias; it may be used for a completely different application; occasionally it may be valuable for the same purpose; or some of the chemical constituent may provide the synthetic chemist with an unknown base on which to create new compounds Schultes & Swain (1976). Hence, our insistence on ''ethnobotanical conservation'', before we lose this ''short cut'' into the study of bioactive plants.

There is not much time for us to carry out studies--especially chemical and pharmacological--on psychoactive plants of primitive societies. Their knowledge of the medicinal, narcotic and other physiological effects on the body has been acquired over hundreds, perhaps thousands, of years by experimentation in a flora calculated to have in the Amazon some 80.000 species of plants. If chemists are to procure material and analyze this number of plants, the task will never be completed. The constant advance of western civilization into far-off regions is rapidly destroying the native cultures. In the Amazon, the arrival of ''civilization'' with our own effective medicines, leads often in one generation to loss of the traditional knowledge of ''medicinal'' and toxic plants.

III.

In my field work amongst aboriginal societies in the United States, Mexico, the northern Andes and Amazon, I have had always to try to view the use of hallucinogens and other psychoactive drugs amongst primitive societies (the same may be true in our so-called advanced societies) as natural magico-medico-religious attempts basically to escape from what one writer has described as the ''intolerable clutch of reality'' (Taylor 1949).

IV.

When a traveller asked a poor Guatemalan peasant why he drank so much liquor, he was astonished at the reply: ''A man must have a rest from his mind once in a while.''

The peasant had hit upon the basic reason for the use of intoxicants--whether it be use, misuse or abuse: escape from that ''intolerable clutch of reality.''

The busy executive who relaxes at home in the evening with a cocktail or a cigar seeks a respite from the pressures of the day. The man who occasionally takes hard drugs may be seeking relief from an unbearable situation or be yearning for happier conditions forever lost.

The doctor administering narcotics to a suffering patient is trying to bring about

escape from the reality of pain. Even the aboriginal medicine-man or shaman ceremonially taking preparations of mind-altering plants to diagnose diseases, to seek cures, to prophesy the future is actually fleeing from the confines of ordinary reality by attempting to consult with elements that he believes live in the spirit world.

Thus, the hallucinogens, manipulated by the medicine-men, transport man from this mundane sphere to realms of ethereal wonder where, through hallucinations--especially visual and auditory--he can contact the spiritual forces whence he believes come all of mankind's woes, sickness and death.

Curiously, the drug addict of our modern civilisation is similarly attempting, for a variety of reasons, to escape from what he considers an oppressive reality (Schultes & Hofmann 1979). The German toxicologist, Louis Lewin, expressed it in a majestic way (Lewin 1931, 1964). "If human consciousness is the most wonderful thing on earth, the attempt to fathom the depths of the Psychophysiological action of narcotic and stimulating drugs make this wonder seem greater still, for with their help man is enabled to transfer the emotions of everyday life, as well as his will and intellect, to unknown regions; he is enabled to attain degrees of emotional intensity and duration which are otherwise unknown to the brain. Such effects are brought about by chemical substances. The most powerful of these are products of the vegetable kingdom.... Miracles like these are performed throughout the world by these strange substances wherever men are in possession of any of them." (Lewin 1931).

One drug varies in effects to the next, but the same drug may vary in its effects on a single person at different times and at different states of health and relaxation of the individual. Consequently, it is difficult or impossible to pin-point in detail the effects of any mind-altering plant or substance; only very general descriptions of their biological activities can usually be given (Hollister 1968).

The great diversity in the effects of different drugs is no better illustrated than by this famous anecdote. Three men, travelling in the Orient, reached a walled city at dusk, just as the great gates were shut. One of the travellers, drunk with alcohol, beat furiously upon the iron gates with his sword, yelling for those inside to open them and let him in. The second, intoxicated with opium, tried to calm the alcoholic, saying: "It is warm. Let us sleep comfortably outside the city and enter to-morrow when they open the gate." The third man, under the heavy influence of hasheesh, said: "You are both crazy. We'll go in right now through the keyhole."

V.

It should always be borne in mind that there is a very significant difference between *addiction* and *habituation*. These terms are too often loosely used. To-day, better terms are recommended: *physical dependence* and *psychological dependence*. Actually, very few psychoactive substances of plant origin can be truly addictive, although the use of many may lead to habituation. People everywhere tend to become habituated to ingested substances; many in our culture, for example, do not feel that they can start the day comfortably without their morning cup of coffee or tea: this represents psychological dependence; it is basically very difficult from physiological dependence.

VI.

My principal interest in studying hallucinogenic drugs and of identifying poorly known or unknown psychoactive plants has been centered--admittedly in a very limited way--on the possibilities of finding new chemical substances of vegetal origin that may be of service in modern medicine and psychiatry (Schultes 1987a). Several hallucinogenic alkaloids are now in use in psychiatry: mescaline and psilocybine. There is every possibility that new and medicinally useful semi-synthetic analogues of hallucinogenic alkaloids may be found: a good example is a widely prescribed beta-blocker for cardiac problems— a semi-synthetic analogue of psilocybine, visken. A number of the tropane alkaloids, of course, have long been major items in our pharmacopoeias.

VII.

When the Spanish Conquistadores of Mexico arrived, completely subservient to European culture and to the authority of the Roman Catholic Church of that period, they were astonished that the Aztecs and other Indians were worshipping their deities with the help of hallucinogenic plants, especially the mushrooms and peyote. At that early period, the Europeans could not resist persecuting such "dangerous" pagan beliefs. As a result of their ecclesiastical diatribes, we know considerable about the early indigenous use of Mexican hallucinogens. These ceremonies have persisted in southern Mexican. We now know, furthermore, that many hundreds of years earlier, there were sophisticated magico-religious ceremonies surrounding the use of psychoactive mushrooms in Guatemala (Borhegyi 1960, 1961), and archaeological finds in Mexico and Texas spanning 8000 years indicate the ceremonial use of the peyote cactus (Schultes 1987; Adovasio & Fry 1976).

All of the so-called sacred psychoactive plants except coca (*Erythroxylon* spp.) in tropical America have persisted in their use as ceremonially magico-religious elements. Only the coca plant has become an hedonistically employed element--and there are indications, even to-day, that this plant, once reserved for use as a specifically sacred part of the culture, has conserved remnants of its particular role, as evidenced from certain beliefs about its origin and the almost ceremonial way in which it is cultivated and harvested, especially in the Amazon regions (Plowman 1981, 1984; Schultes 1981).

VIII.

Pre-literate people--especially those living in very close association with Nature--try to explain all phenomena (Schultes 1988). How can they explain the weird and unearthly effects of plants like the hallucinogens? They believe that some spirit or spiritual force resides in these few plants. Since sickness and death in primitive societies is ascribed usually to malevolent spirits from outer, normally invisible realms, with which the medicine-man or witch-doctor can communicate through visual, auditory or other hallucinations, these vegetal residences of spiritual forces are considered sacred and are used and treated with reverence. We know

that these "spiritual forces" are powerful chemical substances, some of which have already found experimental or therapeutic use in modern medicine (Schultes & Hofmann 1979; Schultes & Swain 1976).

Aboriginal peoples everywhere are intensely curious. This curiosity leads usually to experimentation. The discovery of the properties of plants is the result of thousands of years of experimentation with the ambient vegetation (Schultes 1972). While primitive societies nearly the world over have discovered and valued mind-altering plants, the area of their greatest use is centered in tropical America. More than 100 species are known to be employed in the New World in contrast to fewer than 12 or 15 in the Old World, a part of the world with much older cultural history (La Barre 1970).

IX

The Plant Kingdom is divided into eight large groups: the bacteria; the algae (sea weeds, etc.); the fungi (mushroms, moulds, etc.); the bryophytes (mosses and liverworts); the ferns and fern-allies; the gymnosperms (plants with naked seeds, including the cone-bearing and needle-leaved trees); and the angiosperms (commonly known as the flowering plants) (Schultes & Swain 1976). Physiologically active plants--at least those employed by man for their psychoactivity--are not scattered at random throughout the Plant Kingdom (Schultes 1970). The bacteria, algae, lichens, bryphohytes, ferns and their allies and the gymnosperms are conspicuously lacking in the list of mind-altering drugs. They are concentrated in the fungi and the angiosperms.

Man has learned to employ only a few of the species in the world's floras that actually do possess psychoactive principles. There are certainly many more species with psychoactive constituents than the few that are now in use by man.

X.

Hallucinogenic and narcotic activity in plants is ascribed to but a few kinds of organic chemical constituents. They can conveniently be divided into two broad groups: those containing nitrogen in their structure; and those which lack nitrogen.

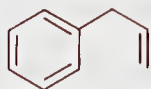
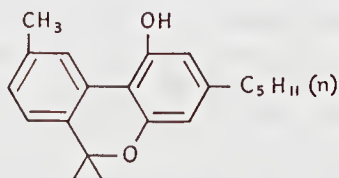
The nitrogenous compounds play by far the greater role and comprise, for the most part, substances known as alkaloids or related constituents. The major psychoactive alkaloids are classified, according to their molecular structure, into nine groups: the beta-carbolines; ergolines; indoles; isoquinolines; isoxazoles; beta phenylethylamines; quinolizidines; tropanes; and tryptamines. The substances with an indole nucleus are the most important from the point of view of the study of psychoactivity; and of these, the tryptamines are extremely interesting, since, as products of tryptophane, they are related biogenetically to proteins and because man has in his central nervous system a tryptamine known as serotonine. The non-nitrogenous compounds which are the active principles in several hallucinogens include the dibenzopyrans (known only in the genus *Cannabis*) and the phenylpropenes (found in several spice plants)(Schultes 1970).

Other compounds--catechols and alcohols, for example--may occasionally play

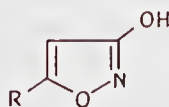
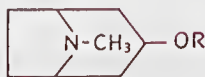
Ethnobotanical research with a Kamsá Indian medicine-man in the Valley of Sibundoy in Colombia. Photograph: Schultes.

BASIC CHEMICAL SKELETONS OF PRINCIPAL HALLUCINOGENS

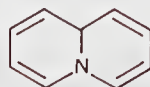
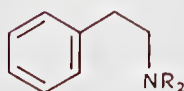
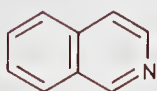
Non-nitrogenous compounds

CH_3 OH C_5H_{11} (n) O

Phenylpropenes

Dibenzopyrans

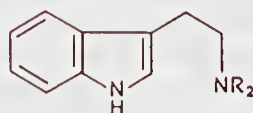
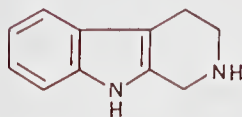
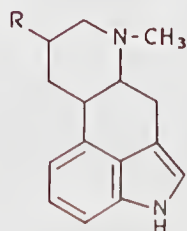
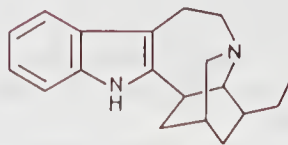
Nitrogenous compounds

OH R O N N-CH_3 OR N

Isoxazoles

Tropanes

Quinolizidines

NR_2 N N H NR_2

Phenylethylamines

Isoquinolines

Tryptamines

R N-CH_3 NH N H N H N N H

β- Carbolines

Ergolines

Iboga-indoles

a psychoactive role but usually not as true hallucinogens.

There are some psychoactive plants employed in remote primitive societies that have not even been botanically determined, while others, botanically known, have not yet been chemically elucidated.

XI.

Mind-altering or psychoactive drugs have been classified in many ways: according to their physical or psychological effects, their chemical composition and from other viewpoints.

The simplest classification--and one that seems most often to work--is that proposed by (Lewin 1931). He divided the narcotic and stimulant drugs (in German, his *Genussmittel*, a conveniently inclusive term signifying "means of enjoyment"), into five categories: *Inebriantia* (causing primarily cerebral excitation followed by a depressive state; mainly alcohol); *Excitantia* (mental stimulants; mainly caffeine-containing plants); *Euphorica* (sedatives of mental activity: opium, cocaine, etc.); *Hypnotica* (sleep-producing agents, particularly kava-kava); *Phantastica* (hallucination-inducing substances).

XII.

What should we call the psychoactive drugs?

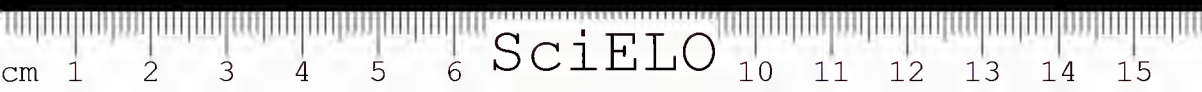
As with every fast-developing field of research, there has grown up a plethora of terms concerned with these agents.

In Europe, the terms *phantastica* and *phantasticants* are in common use. In the United States, the term *hallucinogen* ("generating hallucinations") is perhaps the most frequently found in scientific writings. But numerous terms are also current: *psychotomimetics*, *schizogens*, *eidetics*, *psychotica*, *psychoticants*, *psychogens*, *psychodisleptics* and others. Recently, the term *entheogens* ("God within us") has been proposed to signify the belief amongst primitive societies in the sacred character of these plants. Unfortunately the most widely accepted term in the United States--*psychedelic* (purported to mean "delimiting the mind") is etymologically unsound and biologically inaccurate; and, as a result of its popular misuse during the hippy era, it has acquired secondary, tertiary, and other meanings wholly divorced from the effects of psychoactive drugs.

It is true that no one term describes satisfactorily to every scientific discipline the effects of these intoxicating plants. While accepting the easily understood term *hallucinogen*, I realize that not all do induce true hallucinations. Some may cause psychotic states: the meaning of the term *psychotomimetic*. Only a few can lead to schizophrenic conditions, so the term *schizogen* must be considered as limited.

Although I realize how deficient it is, the term *hallucinogen* will be used in the following pages: it is simple, its meaning is direct, and it is an easily understood word.

XIII.

Another aspect that must be considered is the great diffference between the use of plant tissue more or less in the natural state and the use of the active chemical

compounds isolated and purified from vegetal sources. In the first instance, plant material may be chewed, drunk in the form of a tea, smoked or snuffed; the amount of the total active constituents that eventually finds its way into the blood stream is usually very limited. In the second case, relatively large amounts of concentrated chemical substances (applied hypodermically) usually can enter directly into the blood stream producing much more potent effects. It is noteworthy to realize that the psychoactive plants employed medically or magico-religiously in primitive ceremonies--that is, of those under consideration in the following pages--are utilized in a form which we can call the natural state. Isolated chemical constituents are obviously not available to people in primitive societies.

XIV.

In view of the pervasive importance of psychoactive plants and their products in human societies, it is appropriate to recall the words of Louis Lewin, one of the pioneers in the interdisciplinary study of those agents which he termed the *phantasticants.*

"These substances have formed a bond of union between men of opposite hemispheres, the uncivilized and the civilized; they have forced passages which, once open, proved of use for other purposes; they produced in ancient races characteristics which have endured to the present day, evidencing the marvellous degree of intercourse that existed between different peoples just as certainly and exactly as a chemist can judge the relations of two substances by the reactions." (Lewin 1931).

PSYCHOACTIVE PLANTS
FUNGI

Dictyonemataceae Tomaselli
Dictyonema C. A. Agardh ex Kunth
Dictyonema sp.

The Waorani Indians of Ecuador have two hallucinogens:
Banisteriopsis muricata and a species of the basidiolichen *nenendape* (Davis & Yost 1983).

This Dictyonema was formerly employed in shamanistic rituals, but it is apparently no longer used. It was taken "when bad shaman ate it to send a curse to cause other Waorani to die." It is said to have been prepared as an infusion with certain species of bryophytes called *kigiwai*, and it caused headaches and confusion; another effect attributed to its use was sterility, and it was given to children to induce barrenness (Davis & Yost 1983).

Nothing is known of the chemical constituents of this curious plant.

Lycoperdaceae Puff—ball Family
Lycoperdon Persoon

Lycoperdon marginatum Vittadinio, Journ., Mem. R. Acad. Sci.Torino, ser. 2, 5 (1843) 185.

Lycoperdon mixtecorum Heim, Comptes Rendue 254 (1962) 789.

Several species of Lycoperdon are reported to be used by the Mixtecs in Oaxaca, Mexico, as auditory hallucinogens. They cause voices to be heard during a state

of half-sleep that begins half an hour after ingestion (Heim 1967; Ravicz 1960).

Amongst the Tarahumares of Chihuahua, Mexico, it is reported that a puff-ball, known locally as *pata de perro*, is employed "by witches" (Bye 1976).

The two major puff-balls involved in Oaxaca are *Lycoperdon mixtecorum* (in the Mixtec language *gi-i-wa* or "fungus of first quality") and *L. marginatum* (*gi-i-sa-wa* or "fungus of second quality"). The former species is said to be the more active (Schultes & Hofmann 1980).

That Lycoperdon does contain psychoactive constituents is suggested by a detailed report dating from 1869 citing two cases of narcotic effects of puff-balls-one in southwestern United States,the other in Georgia (Schultes & Hofman 1980).

More field investigation is needed before a clear understanding of this auditory hallucinogen can chemically and pharmacologically be explained.

Strophariaceae Stropharia Family
Panaeolus (Fries) Quélet
Panaeolus sphinctrinus (Fr.) Quélet, Les Champignons du Jura et des Vogues, pt. 1 (1872) 151.
Psilocybe (Fries) Kummer
Psilocybe mexicana Heim, Competes Rend. 242 (1956) 967; Rev. Mycol. 22 (1957) 77.
Stropharia (Fries) Quélet
Stropharia cubensis Earle, Est. Agron. Cub. 1 (1906) 240.

In southern Mexico, some two dozen species of mushrooms are employed in magico-religious rites (Heim 1963). They belong especially to several closely related

One of the "mushroom stones" of the highland pre-classic Mayan period in Guatemala, dated 500 BC to 200 AD.
Photograph: Gordon and Tina Wasson Ethnomy-cological Collection, Harvard Botanical Museum.

genera: particularly to *Panaeolus*, *Psilocybe* and *Stropharia*. All of the species have the same active alkaloids: psilocybine (an indole with a phosphorylated hydroxyl radical, an acidic phosphoric acid ester of 4-Hydroxydimethyltryptamine) and the rather unstable psolicine. It is of interest that psilocybine is substituted in the 4 position (Schultes & Hofmann 1980).

It is of also interest to note that one of the alkaloids--psilocybine--has been used in psychiatry.

The ceremonial use of inebriating mushrooms is known to have existed in very ancient times. Frescoes from central Mexico, dating back to 300 AD, have designs that seem to put mushroom worship back nearly two millennia. Even more remarkable and older are the archaeological artifacts now called "mushroom stones", excavated in great numbers from highland Mayan sites in Guatemala; these effigies are variously dated but go back at least to 1000 BC. They consist of an upright stem with a man - or animal- like figure crowned with an umbrella-shaped top.

We know much about the sacred use of mushrooms in post-Conquest times, because the ecclesiastical authorities wrote so much about *teonanacatl* ("flesh of the gods") and even illustrated the fungi in official records and other documents. A report written in the mid-1500's referred several times to mushrooms "...which are harmful and intoxicate like wine" so that those who partake of them "...see visions, feel a faintness of heart an are provoked to lust." In one reference, this report detailed the effects, saying that the natives ate them with honey and "...when they begin to be excited by them start dancing, singing, weeping. Some do not want to eat but sit down...and see themselves dying in a vision; others see themselves being eaten by a wild beast; others imagine that they are capturing prisioners of war, that they are rich, that they possess many slaves, that they had committed adultery and were to have their heads crushed for the offense...and when the drunken state has passed, they talk over amongst themselves the visions which they have seen" (Wasson & Wasson 1957).

One of the early Spanish ecclesiastical writing was even more indignant. It reported in part the following: "They had another way of drunkenness that made more cruel, and it was with some fungi or small mushrooms...of such a kind that, eaten raw and being bitter, they drink after them or eat with them a little bee's honey; and a while later they would see a thousand visions, especially serpentes and as if they were out of their senses, it wourld seem to them that their legs and bodies were full of worms eating them alive, and thus half rabid they would sally forth from the house, wanting someone to kill them, and with this bestial drunkenness...it happened sometimes that they hanged themselves, and also against others they were crueler" (Wasson & Wasson 1957).

There are other references to these sacred fungi in the early writings. One recorded that inebrianting mushrooms were part of the coronation feast of Montezuma in 1502. Dr. Francisco Hernández, personal physician to the King Spain, who studied the medicinal lore of Mexican Indians for a number of years in the field, wrote of three kinds of mushrooms used as intoxicants and worshipped. Of some, called *teyhuintli*, he explained that they "cause not death but madness that on ocasion is lasting, of which the symptom is a kind of uncontrolled laughter...they are deep yellow, acrid and of a not displeasing freshness. There are others again which, without

inducing laughter, bring before the eyes all sorts of things, such as wars and the likeness of demons. Yet others there are not less desired by princes for their festivals and banquets, and these fetch a high price. With night-long vigils are they sought, awesome and terrifying. This kind is tawny and somewhat acrid'' (Schultes 1939, 1978a).

The Spanish authorities had been so successful in driving this cult into the hills that in more than four centuries anthropologists had not met a mushroom ceremony in Mexico. In 1915, the suggestion was made that, since dried mushrooms resemble the dried tops of the peyote cactus, *teonanacatl* was another name for *peyote*, that both names referred to the same plant. It was suggested further that the Indians, to protect the sacred *peyote*, were pointing out mushrooms to fool the Spanish authorities (Safford 1915). This misidentification of *teonanacatl* was widely accepted, not withstandin protests, until the 1930's when identifiable specimens of *Panaeolus sphinctrinus* and another mushroom were collected with data on their use as hallucinogens by the Mazatecs of Oaxaca. The second mushroom was not botanically identified until a number of years later, when it was determined as *Stropharia cubensis*.

In 1953, fortunately, the ethnomycologic team of R. Gordon Wasson and his wife, having read the earlier identification of *Panaeolus sphinctrinus* as an hallucinogen, began a series of well organized expeditions to various parts of Oaxaca. Sensing the need for interdisciplinary and intensive study of all aspects of the use of the mushrooms, Wasson enlisted the collaboration of sundry specialists--anthropologists, linguistic scholars, chemist, mycologists, musicoligists and others. As a result of this serious investigation and later studies by other mycologists, it is now known that some 25 species of mushrooms are ritualistically employed in southern Mexico (Singer 1958).

This relatively large number of mushrooms is employed as divinatory and ceremonial agents in modern Mexico, and probably as many were known to the ancient inhabitants of the Aztec empire. The species involved includes amongst others: *Psilocybe mexicana, P. caerulescens* var. *mazatecorum; P. caerulescens* var. *nigripes; P. yungensis; P. mixaeensis; P. hoogshagenii; P. aztecorum; P. muriercula; Stropharia cubensis; Conocybe siligineoides; Panaeolus sphinctrinus*.

Undoubetedly there were many tribes in ancient Mexico who employed *teonanacatl*, but we know with certainty only of the Chichimilcas, who spoke Nahuatl. To-day we know that the sacred mushrooms are consumed by Mazatecs, Chinantecs, Chatinos, Zapotecs, Mixtecs and Mijes--all of Oaxaca, and by the Nahoas of Mexico; and possibly by the Tarascanas of Michoacan and the Otomis of Puebla.

Aside from the all-important hallucinogenic effects of mushrooms employed ritualistically in Mexico, the most outstanding symptoms are: muscular relaxation, flaccidity and mydriassis early in the intoxication, followed by a period of emotional disturbances such as extreme hilarity and difficulty in concentration. It is at this point the visual and auditory hallucinations appear, eventually to be followed by lassitude and mental and physical depression, with serious alteration of time and space perception. One peculiarity of the narcosis which promises to be of interest in experimental psychiatry is the isolation of the subject from the world around him--that is, without a loss of consciousness, he is rendered completely indifferent to his

environment, which becomes unreal to him as his dreamlike state becomes real (Hollister et al. 1960; Schultes & Hofmann 1980).

The psychotomimetic effects following the ingestion of 32 dried specimens of *Psilocybe mexicana*, as described by Hofmann, are significant: "As I was perfectly well aware that my knowledge of the Mexican origin of the mushroom would lead me to imagine only Mexican scenery, I tried deliberately to look on my enviroment as I knew it normally. But all voluntary efforts to look at things in their customary forms and colours proved ineffective. Whether my eyes were closed or open, I saw only Mexican motifs and colours. When the doctor supervising the experiment bent over me to check my blood pressure, he was transformed into an Aztec priest, and I would not have been astonished if he had drawn an obsidian knife. In spite of the seriousness of the situation, it amused me to see how the Germanic face of my colleague had acquired a purely Indian expression. At the peak of the intoxication, about 1½ hours after ingestion of the mushrooms, the rush of interior pictures, mostly abstract motifs rapidly changing in shape and colour, reached such an alarming degree that I would be torn into this whirlpool of form and colour and would dissolve. After about six hours, the dream came to an end. Subjectively, I had no idea how long this condition had lasted. I felt my return to everyday reality to be a happy return from a strange, fantastic but quite really experienced world into an old and familiar home" (Hofmann 1978).

Amongst the Mazatecs, the shaman may often be a woman. One of the most famous female shamans enacted the all-night mushroom velada for the first time to people of European or North American culture: it was a velada at which Wasson was present. The participants took their portions of mushrooms by 1 A.M. Visions began twenty minutes later. No one slept until 4 in the morning. In Wasson's words, "...it was as though my very soul had been scooped out of my body and transferred to a point floating in space...Our bodies lay there, while our souls soured...we were seeing visions...at first...geometric patterns, angular not circular, in richest colours...Then the patterns grew into architectural structures...in richest magnificence extending beyond the reach of sight....We were split in the very core of our being. On one level, space was annihilated for us, and we were travelling as fast as though to our visionary worlds."

When the last candle was extinguished, the shaman "began to moan, low at first, then louder. Then the humming stopped, and she began to articulate isolated syllables, each syllable consisting of a consonant followed by a vowel. The syllables came snapping out in rapid succession, spoken, not sung, usually almost ventriloquistically. After a time, the syllables coalesced into what we took for words, and the Señora began to chant. The chanting continued intermittently all night..."

"The chanting and the oracular utterance turned out to be only a part of what we were to witness...the Señora was either kneeling or standing before the altar table gesticulating...Then much later, the Señora made her way to the open space...and embarked on a kind of dance that must have lasted for two hours or more" (Wasson 1957).

A complicated curing or diagnostic ritual frequently takes place during the all-night ceremony.

There are specific characteristics of the ceremony or velada: 1) Mushrooms are

The famous medicine woman of Jiménez de Huautla, Oaxaca, of the Mazatec tribe, participating in an all-night curing ceremony with the use of the sacred mushrooms, species of *Psilocybe*. Photograph: Tina and Gordon Wasson Ethnomycological Collection, Harvard Botanical Museum.

taken usually fresh; 2) The velada is held in response to a request by a person needing to consult the mushrooms about a problem; 3) Darkness and isolation are requisites to the velada; 4) One or two monitors who do not take the mushrooms must be present to listen to what is said; 5) There are certain facts and abstinences preparatory to the ceremony.

Brief passages from the shaman's chanting state the following:

"The law which is good,
Lawyer woman am I.
Woman of paper work am I,
I go to the sky,
Woman who stops the world am I,
Legendary woman who cures am I.
Father Jesus Christ
I am truly a woman of law,
I am truly a woman of justice....

Woman of space am I,
Woman of day am I,
Woman of light am I,
No one frightens him
No one is two-faced to me....
I give account to my Lord,
And I give account to the judge,
And I give account to the government,
And I give account to the Father Jesus Christ,
And mother princess, my patron mother,
Oh Jesus, Father Jesus Christ,
Woman of danger am I, woman of beauty am I...."

(Wasson ; Cowan & Rhodes 1974)

The use of psychoactive mushrooms is not now known from any aboriginal group in South America. However, many anthropomorphic archaeological gold pectorals from the Sinú culture of Colombia have been interpreted as suggesting the ceremonial use of mushrooms. The earlier more realistic artifacts have dome-like caps, separeted from the head by stipes, and appear extremely mushroom-like; later artifacts became rather stylized, the domes losing their stipes and becoming affixed to the idol. These artifacts have been commonly called "telephone bell gods." They are dated roughly between 500 and 600 AD. It is perhaps significant that several species of *Psilocybe* containing the active principles have been collected in the region of northern Colombia where these Indians lived (Schultes & Bright 1979).

The Yurimaguas Indians of the westernmost Amazon basin in Peru were reported by Jesuit missionaries in the late 17th and early 18th Centuries to be drinking a strongly intoxicating beverage prepared from a "tree fungus". *Psilocybe yungensis* has been sugested as the identification of this "tree fungus". Field work in this region has, up to the present, not disclosed any practice of this kind, but it represents a

culture trait little likely to disappear spontaneously without leaving a trace at least, an the region is still inhabited by many tribes in relatively primitive conditions of culture. The report states that "...the Yurimagus mix mushrooms that grow on fallen trees with a kind of reddish film that is found usually attached to rotting trunks. This film is very hot to the taste. No person who drinks this brew fails to fall under its effects after three draughts of it, since it is so strong or, more correctly, so toxic." If the fungus be truly *Psilocybe*, what, then, might this "reddish film" be? (Schultes & Hofmann 1979).

MONOCOTYLEDONEAE
Gramineae   Grass Family
Cymbopogon Sprengel
Cymbopogon densiflorus Stapf, Prain, Fl. Trop. Afr. 9 (1918) 289.

This tropical African grass has been reported as an hallucinogen in Tanganyika: "Flowers smoked alone or with tobacco by witch doctors cause dreams. It is said that these dreams foretell the future" (von Reis & Lipp 1982).

No psychoactive constituents are known from this species. A number of the 60 species of *Cymbopogon* are rich in essential oils. *Cymbopogon densiflorus* is pleasantly aromatic of citron, and its leaves and rhizomes are locally valued as a tonic or styptic.

Cyperaceae   Sedge Family
Scirpus Linnaeus
Scirpus sp.

It appears that one of the most highly regarded herbs amongst the Tarahumare Indians of Mexico is a species of *Scirpus* called *bakana* or *bakanawa*, the same name as that applied to the psychoactive cactus (*Coryphantha compacta*) (Bye 1976).

This plant has a strong hold on the local Indians. Medicine-men may carry the plant to relieve pain or keep the tuberous parts of the plants on their person to help cure insanity. The Tarahumares fear to cultivate *bakana* because they believe that it emits loud noises that will drive a person mad. If the plant be mutililated, it may kill the person responsible or induce permanent insanity. Before using the plant, the Indian must sing to it or offer it food.

If one eats the bulbs, it is reported, he falls into a sound sleep during which he makes long trips and talks with long-dead relatives; brilliantly coloured visions are experienced.

There are 300 species of *Scirpus*, a grass-like plant distributed cosmopolitanly, especially in heaths, moors, bogs and swamps. The species employed by the Tarahumares as an hallucinogen has not yet been chemically analyzed, but psychoactive alkaloids of the harmala series and unnamed alkaloids have been found in several general in the Cyperaceae (Willaman & Li 1970).

Araceae   Arum Family
Acorus Linnaeus
Acorus Calamus Linnaeus, Sp. Pl. (1753) 324.

There is indirect evidence suggesting that Cree Indians of northwestern Canada, who chew the root of this semi-aquatic herb (known as *sweet flag*, *flag-root* or *sweet calomel)* for a variety of medicinal purposes and as a strong stimulant, may occasionally value it for its psychoactive effects: a native informant reported that, when he chewed it on long walks, he felt as though he were walking a foot off the ground (Hoffer & Osmond 1967). Experiments have shown that in excessive doses it has effects similar to those of LSD. It is reported that during the 1930's, it was chewed by people in England who, during the economic depression, were too poor to buy tobacco.

It has been suggested that the active principles are two kinds of asarone, a constituent of the root-oil with a chemical resemblance to the hallucinogenic alkaloid mescaline; no psychoactive, however, has been attributed to asarone. Further ethnobotanical and chemical research must be done before the hallucinogenic use of *sweet-flag* by North American Indians is settled.

Homalomena Schott
Homalomena belgraveana Sprague, Journ. Bot. 60 (1922) 138.

The natives of Papua eat the leaves of an unidentified species of this aroid, called *ereriba*, together with the leaves and bark of *Galbulimima belgraveana*, a large tree of the Himantandra family (Barrau 1958, 1962). A violent intoxication leading to sleep and visual hallucinations results: the natives believe that the visions enable them to see dream about the men animals that they want to kill.

There are more than species of *Homalomena* in tropical Asia and South America. Many species are pleasantly aromatic and the root-stalks have a variety of medicinal uses in folk medicine, especially in the treatment of skin problems. In Malaya, one species is an ingredient of an arrow poison. No chemical constituent capable of hallucinogenic activity, however, has as yet been reported from *Homalomena* (Schultes & Hofmann 1980).

Amaryllidaceae Amaryllis Family
Pancratium Linnaeus
Pancratium trianthum Herbert, Ann. Nat. Hist., ser. 1, 4 (1840) 28.

Little is known about the use of this bulbous perennial by the Bushmen in Botswana, who call the plant *kwashi*. The bulb is said to be sliced and rubbed over incisions made in the scalp to induce visual hallucinations (Schultes & Hofmann 1979, 1980). This method of employing a psychoactive plant is interesting, particularly because it seems to represent the closest that primitive peoples have come to the hypodermic syringe of western medicine: injecting active principles directly into the blood stream!

There are fifteen species of *Pancratium*, native primarily in Asia and Africa. Many are potent cardiac poisons; some are used as emetics; one species can cause death by paralyzing the central nervous system. Most of the toxic principles are alkaloids (Raffauf 1970).

Zingiberaceae Ginger Family
Kaempferia Linnaeus
Kaempferia galanga Linnaeus, Sp. Pl. (1753): 3.

Vague reports indicate that this species, known as *maraba*, may be used hallucinogenically in New Guinea (Barrau 1962).

The rhizome is rich in essential oils and is a favourite condiment and medicine in tropical Asia. In the Philippines, the rhizome is mixed with oils and employed as a cicatrizant and is applied to boils and ulcers to bring them to a head. Some species of *Kaempferia* are valued to hasten the healing of wounds and burns (Uphof 1968).

Phytochemical data on this species are almost completely lacking, and nothing is known of hallucinogenic constituents in the plant.

Orchidaceae   Orchid Family

Oncidium Swartz

Oncidium cebolleta (Jacq.) Swartz, Vet. Akad. Handl. Stockh. 21 (1800): 240.

This epiphytic orchid is used by the Tarahumares as an hallucinogen when there is no *peyote (Lophophora williamsii)* available (Bye 1979).

An alkaloid has been reported from this species, but its structure is unknown (Willaman & Li 1970).

DICTOTYLEDONEAE

Moraceae   Mulberry Family

Helicostylis Trécul

Helicostylis pedunculata Benoist, Bull. Mus. Hist. Nat. Paris 25 (1919): 298.

Helicostylis tomentosa (P. et E.) Rusby, Mem. Torr. Bot. Club 6 (1896): 120.

The Karib Indians of the Guianas and northeastern Brazil recognize *Helicostylis tomentosa* as *takini*. From the red "sap" of the bark, a poisonous intoxicant is prepared (Schultes & Hofmann 1980; Stahel 1944; Ostendorf 1962).

The Indians and Bush-negroes of Dutch Guiana value the "sap" to induce hallucinations in ceremonial witchcraft. The effects are described as similar to those induced by Cannabis. Pharmacological studies have been carried out (Buckley et al. 1973). Chemical analyses made earlier appear to suffer from lack of reliable botanical identification of the material investigated (Schultes & Farnsworth 1980).

Maquira Aublet
Maquira sclerophylla (Ducke) C. C. Berg, Acta Bot. Neerl. 18 (1969): 463.

Indians of the Pariana region of the central part of the Brazilian Amazonia formally prepared an hallucinogenic snuff employed in ceremonial dances. Although its use has apparently died out, the snuff and its effects are remembered by natives of the area (Schultes & Hofmann 1980).

The snuff, now known only by the its Portuguese name *rapé dos indios*, was prepared from the fruits of this very tall forest tree.

Although no chemical studies have been carried out on these fruits, it is perhaps pertinent to note that a related species, *Maquira coriacea* of northern South America, is reported to be a deadly poison (Berg 1972).

This species was formerly known as *Olmedioperebea sclerophylla*.

Piperaceae Pepper Family
Piper Linnaeus
Piper methysticum Forster fil., Pl. Escul. (1786): 76.

The *kava-kava* plant is cultivated, a shrub growing to six or eight feet in height with glossy green leaves (Forster 1786). It is the source of a bitter resinous drink that induces a state of peacefulness and an eventual period chacacterized by a pseudo-hypnotic and somnabulistic condition. It is not truly an hallucinogen, but it has been classified as an hypnotic narcotic: it acts as a sedative and soporific. Its use is almost universal in Oceania, especially in Fiji (Lewin 1931; Deihl 1932; Getty 1956; Shulgin 1973).

The thick, aromatic greyish green roots are debarked and cut into small segments. The pieces are chewed, often by children, and spat into a large wooden bowl; water is added; the mixture is then strained and distributed in coconut bowls--half a bowl being sufficient to begin psychoactive effects. The aqueous liquid may be ingested fresh or it sometimes may be allowed slightly to ferment.

The use of this drink is intricately associated with the social, political and religious life of the peoples of Oceania, especially in religious and festive ceremonies, as a token of friendliness and goodwill and even, in some areas, as a daily beverage.

The oldest historical records of the use of *kava-kava* are those concerning Samoa. The first high chief of Samoa was supposed to have been given *kava-kava* by the Sun God to Tagaloa Ui, high chief of the Samoans. Tagaloa-Ui taught the Samoans how to utilize the plant. The first mortal being who took part in the *kava-kava*

ceremony ridiculed the use of the drug, but Talaloa-Ui instructed the Samoans in the proper use of *kava-kava*. Rituals and ceremonies to-day, by clapping of hands, recall this semi-mythological instruction into the use of *kava-kava*.

As do the myths surrounding the use of psychoactive drugs around the world, this belief relates to the "sun, sky, earth, plants and animals, as well as attributed to the Divine Being, the mortal self, birth, death, resurrection, marriage, mystical spirit flight and shamanistic transformation."

When western missionaries arrived in the Pacific islands, they persecuted the use of *kava-kava*, in some islands extinguishing the custom; the void was filled with the much more pernicious introduction and use of distilled alcohol. The ritual employment of *kava-kava* has, however, survived. In recent years, in a royal ceremony presided over by the Queen of Tonga, both Elizabeth II and the wife of a president of the United States were made welcome with a *kava-kava* ceremony.

The ceremonial use of *kava-kava* remains almost unaltered in Samoa, but in many of the South Seas the use of the drug has lost its ceremonial significance. It is said that *kava-kava* bars are taking the place of coffee houses.

The excessive use of *kava-kava* has been credited with the productions of skin diseases and serious effects on the eyesight.

There are numerous chemotypes of this long-cultivated composition. Ten different constituents belonging to four general chemical types have been isolated from *kava-kava*. Two or three of the compounds in the oleoresin are believed to be responsible for the sedative and hypnotic activity of the plant (Hegnauer 1969).

Aizoaceae Carpet-weed Family

Mesembryanthemum Linnaeus

Mesembryanthemum expansum Linnaeus, Syst., Ed. 10 (1759) 1059 and *M. tortuosum* Linnaeus, Sp. Pl. (1753) 487.

There is evidence that the Hottentots of southern Africa employed these two species as hallucinogenic agents more than 200 years ago. They chewed the roots of a plant called *kanna* or *channa*, and, according to a contemporary report, "their animal spirits were awakened, their eyes sparkled and their faces manifested laughter and gaiety. Thousands of delightsome ideas appeared, and a pleasant jollity which enabled them to be amused by simple jests. By taking the substance to excess, they lost consciousness and fell into a terrible delirium." (Lewin 1931; Schultes & Hofmann 1980).

These two species are still known in southern Africa as *kanna*, and they contain alkaloids with sedative, cocaine-like properties that can produce a state of stupour. There is, unfortunately, no direct evidence, ancient or modern, connecting the Hottentots with this unusual custom of using *Mesembryanthemum*, and it has been suggested that perhaps the plant that they were using two centuries ago was *Cannabis* or a species of *Sclerocarya*, a member of the Cashew Family.

Phytolaccaceae Pokeweed Family

Phytolacca Linnaeus

Phytolacca acinosa Roxburgh, Hort. Bengal. (1814): 85.

Many species of *Phytolocca* have edible leaves, but the roots of many are toxic. The Chinese *shang-lu* has been reported in ancient herbal literature as a medical

panacea. The root is so toxic that its medicinal use was normally external for inflamations. Many Chinese sources attest to the psychoactive properties and state that sorcerers especially appreciated the hallucinogenic properties. One source reports that it known and used hallucinogenically as early as 510 A.D. Five hundred years later, Su Ching wrote that it was "much used by sorcerers in ancient times" and he described a red and a white kind--the white, used in medicine; the red employed "to summon spirits, [but] it is very poisonous. It can....cause one to see spirits." (Li 1977).

Phytolacca acinosa is reported to be rich in saponines. A glycoside has been reported from the leaves of this species, but apparently no narcotic constituent has yet been found in the root (Hegnauer 1969).

Nymphaeaceae Water-lily Family

Nymphaea Linnaeus

Nymphaea ampla (Salisb.) DeCandolle, Syst. 2 (1821): 54.

Nymphaea caerulea Savigny, Ann. Mus. Par. 1 (1802): 366.

There is some evidence suggesting that species of *Nymphaea* have been hallucinogenically employed in both the New and the Old Worlds. This evidence is based primarily on ancient art forms and similar indirect suggestions of sacred use.

It is believed that Aztec *quetzalaxochiacatl* ("the precious water flower") was *Nymphaea ampla*. It was extensively illustrated in Mayan art and frescoes (Emboden 1978, 1979, 1981, 1983).

Recent ethnobotanical investigation in Mexico and Central America have not discovered the use of this water-lily for psychoactive purposes, but there is reason to assume that chemically it could be biologically active: at least 18 alkaloids have been isolated from the family; the activity of some of them could be narcotic (Díaz 1975, 1976 a, 1976 a). One of the active principles in *Nymphaea* in apomorphine: in low doses it can be helpful in treating schizophrenia, whereas, in excessive amounts, it can produce psychotic states.

Similar kinds of evidence suggest that in ancient Egypt the water-lily *Nymphaea caerulea* was considered sacred and was used possibly for psychoactive purposes in ceremonies (Emboden 1981).

Ranunculaceae Crowfoot Family

Ranunculus Linnaeus

Ranunculus acris Linnaeus, Sp. Pl. (1753): 554.

The exact identity of *mao-ken* is not certain, but it seems to be a species of Ranunculus growing along streams in China-- *R. acris* (Li 1977).

This relative of our common buttercup was reported in the early Chinese literature as a plant cusing delirium. A Chinese writer as early as 320 AD reported that "amongst the herbs there is *shui-lang* ("water-lang", a type of *mao-ken*) which is poisonous and, when eaten by mistake, it produces delirium."

A bioactive glycoside--ranuncoside--is a known constituent of *Ranunculus acris* (Hegnauer 1973).

Himantandraceae Himantandra Family

Galbulimima F.M. Bailey

Galbulimima belgraveana (F. Muell.) Sprgue, Journ. Bot. 60 (1922): 138.

In Papua, the natives take a mixture of the leaves and bark of this tall forest tree, which they know as *agara*, together with the leaves of a species of *Homalomena* (Barrau 1958). It is reported that this preparation induces a violent intoxication that eventually turns into a sleep, during which visions and dreams are experienced.

Some 28 alkaloids have been isolated from the bark of this tree. While the principal alkaloid--himbacine--shows antispamodic activity and low toxicity, there is no evidence suggesting that any of the alkaloids from *Galbulimima belgraviana* have narcotic effects (Ritchie & Taylor 1967).

Myristicaceae Nutmeg Family

Virola Aublet

Virola calophylla Warburg, Nova Acta Acad. Leop.-Carol. 68 (1897): 231.

Virola calophylloidea Markgraf, Repert. Sp. Nov. 19 (1923) 24.

Virola elongata (Spr. ex Bth.) Warburg, Ber. Deutsch. Bot. Ges.

Virola theiodora (Spr. ex Bth.) Warburg, Nova Acta Acad. Leop.- Carol. 68 (1897) 187.

Many tribes of the northwest Amazon and uppermost Orinoco prepare a highly intoxicating snuff from several species of *Virola: V. calophylla, V. calophylloidea, V. elongata* and *V. theidora*. The snuff is variously known as *yakee, epena, nyakwana* and *paricá*.

This hallucinogen was first described (without a botanical identification) by the German anthropologist Koch-Grünberg in 1909, who wrote: "Of an especial magical importance are cures, during which the witch-doctor inhales *hakudufha*. This is a magical snuff used exclusively by witch-doctors and prepared from the bark of a certain tree which, pounded up, is boiled in a small earthenware pot, until all the water has evaporated, and a sediment remains at the bottom of the pot. This sediment is toasted in the pot over a slight fire and is then finely powdered with the blade of a knife. Then the sorcerer blows a little of the powder through a reed...into the air. Next, he snuffs, whilst, with the same reed, he absorbs the powder into each nostril successively. The *hakudufha* obviously has a strongly stimulating effect, for immediately the witch-doctor begins singing and yelling wildly, all the while pitching the upper part of his body backwards and forwards" (Koch-Grünberg 1923).

Botanical identification of several of the source species appeared in 1954, from which time on two or three additional species have been found to be employed (Schultes 1954a).

In most of the northwest Amazon and Orinoco areas (especially in Colombia, Brazil and Venezuela), the reddish resin-like exudate of the inner bark is prepared in the form of a snuff, but the Witoto and Bora Indians of Colombia and Peru make pills or pellets of the exudate for ingestion (Schultes 1969; Schultes & Swain 1976; Schultes; Swain & Plowman 1978).

In Colombia, the native medicine-men usually are only members of the tribe to take the snuff. Amongst the Waikas of Brazil and adjacent Venezuela, however, the hallucinogen is used in excess both hedonistically and ceremonially; all adult male members of the tribe may participate. The snuff as prepared by the Waikas from *Virola theiodora* appears to be much stronger that of the Indians of Colombia.

Virola theiodora in flower. Photograph: Schultes.

There are several variants in preparing the snuff, but the generally followed procedure involves scraping the soft inner layer of the bark drying the shavings by gently toasting them over a fire; they are then stored until needed for preparation of a batch of snuff, when they are crushed, pulverized and triturated in a mortar and pestle made of a tropical fruit. The powder is then sifted to a very fine, rich chocolate-brown, highly pungent dust. This dust is then mixed with an equal amount of the ashes of a leguminous tree, *Elizabetha princeps*. Occasionally, the aromatic leaves of *Justicia pectoralis* var. *stenophylla* are toasted and pulverized to be added to the snuff (Schultes & Holmstedt 1968).

A number of other species of *Virola* have been indicated as minor sources of hallucinogenic snuff (Schultes 1978).

Amongst the Waikas, *nyakwana* snuff is taken sometimes hedonistically but for the most part ritually in ceremonies throughout the year. It is used in excess during the endocannibalistic ceremony of three or four days in which the dead of the year before are memorialized. Shamans believe that, with the help of the drug,they can manipulate the friendly or enemy *hekura* spirits for good or even to kill people who live at great distances.

Instead of utilizing *Virola* in the form of snuff, the Witotos and Boras boil down an aqueous extract of the exudate to a thick paste which is rolled into small pellets. These pellets are then coated with a "salt"--the powdered residue from the leached-out bark ashes made from the stumps of cyclanthaceous plants. The pellets are then swallowed or dissolved in water which is drunk. Intoxication begins in five minutes.

A Waika medicine man and his family. Rio Tototobí, Territorio de Roraima, Brazil. Photograph: Schultes

The pellets may be taken to continue the effects.

One group of very primitive Makú Indians living along the Río Piraparaná in Colombia ingest the resin-like exudate crude, scraped from the bark with no other preparation (Schultes & Hofmann 1979).

The active principles of these species of *Virola* are tryptamines. The snuff made exclusively from *V. theiodora* by the Waika Indians along the Río Tototobí in Brazil contains 11% of several tryptamines, 8% of which is 5-methoxy N, N-dimethyltryptamine. There is appreciable variation in alkaloid concentrations between different parts of the same plant (Schultes & Holmstedt 1968).

In some species of *Virola*, small amounts of βeta-carboline derivatives have also been found. They may act as monoamine oxidase inhibitors, thus explaining perhaps the activity of *Virola* pellets when taken orally, since the tryptamines are believed not to be active when taken by mouth, unless in the presence of a monoamine oxidase inhibitor (Schultes & Hofmann 1980). Despite the isolation of monoamine oxidase inhibitors in the form of very small amounts in specimens prepared in the manner of that employed by the Boras and Witotos, one report doubts that "...the oral activity of the myristicaceous pastes is due to the potentiation of the tryptamines via inhibition of MAO by βeta-carbolines; some mechanism other than MAO inhibition must be

sought to account for the oral hallucinogenic activity of the...pastes if they are, in fact, orally active." (McKenna; Towers & Abbott 1984).

That the pastes made from *Virola* are indeed psychoactive is well established by independent reports from many Indians in three different localities and by personal experimentation by several ethnobotanists and phytochemists who ingested pellets prepared by Indians in the field.

Medicine man of the Waika tribe under the influence of halluconegenic snuff prepared from Virola. Rio Cauaburí, Amazonas, Brazil. Photograph: Schultes.

Gomortegaceae   Gomortega Family
Gomortega Ruiz et Pavón
Gomortega keule (Mol.) I. M. Johnston, Contrib. Gray Herb., n.s., 3, no. 70 (1924): 92.

This family has a single genus and one species. It is a strict endemic of the southern Andes of Chile. The family is closely allied to the Lauraceae or Laurel Family. The plant is known as *keule* and *hualhual* in Chile. The Mapuche Indians of Chile formerly valued this plant as a narcotic; the effects may have been hallucinogenic. Chemical studies are needed for this rare and most unusual plant (Mariani 1965; Schultes 1970).

Fumariaceae   Fumitory Family

Fumaria Linnaeus
Fumaria media Desvaux, Journ. Bot. 2 (1809): 357.

In Chile, this plant, native to the Mediterranean parts of Europe, is thought to have sedative and hypnotic properties. It is called *hierba de la culebra* ("snake plant") or *hiel de la tierra* ("earth gall") (Mariani 1965).

The common fumitory, *Fumaria officinalis* of Europe, has protopine and seven other alkaloids (Raffaut 1970), but apparently no report on the chemistry of *F. media* has been published.

Leguminosae   Bean Family

Anadenanthera Spegazzini
Anadenanthera peregrina (L.) Spegazzini, Physis 9 (1923): 313.
Anadenanthera colubrina (Vell.) Brenan, Kew Bull. 2 (1955): 182.

A powerfully hallucinogenic snuff is prepared from the seeds of *Anadenanthera peregrina* (more widely known as *Piptadenia peregrina)* in northern South America, especially in the Orinoco basin, where it is called *yopo* (Altschul 1972); it was apparently employed in pre-colonial times in much of the West Indies, but its use there has died out; it was known in the West Indies as *cohoba* (Safford 1916).

Anadenanthera peregrina occurs naturally in more or less open grasslands and appears to be concentrated in the Orinoco basin and the northernmost part of the Amazon drainage area of Brazil near the Venezuelan border. It still can be found in much of the West Indies, but its habit and distribution there suggests that it was originally an introduced plant.

In the period of European conquest of South America, another psychotomimetic snuff was prepared in southern Peru, Bolivia and Argentina from *Anadenanthera colubrina*, where it was variously known as *vilca, huilca, cebíl* or *sebíl*. This snuff is still employed by Indians in the northern part of Argentina (Califano 1976).

The active principles in both species are primarily tryptamine derivatives and traces of β-carbolines.

The earliest report of this snuff dates from observation made amongst the Taino Indians of Hispaniola in 1496. The observer recorded that "these natives inhaled

Pods of *Anadenanthera peregrina*, Boa Vista, Território de Roraima, Brazil. Photograph: Schultes.

it to communicate with the spirit world and that it was so strong that those who take it lose consciousness; when the stupefying action begins to wane, the arms and legs become loose, and the head droops...and almost immediately they believe they see the room turn upside-down an men walking with their heads downwards" (Safford 1916). The famous explorer of the Orinoco, Gumilla, gave a graphic account of *yopo* intoxication amongst the Otomac Indians in his book *El Orinoco Ilustrado*, published in teh mid-1700's (Gumilla 1745). "They have another most evil habit of intoxicating themselves through the nostrils, with certain malignant powders which they call *yupa*, which quite takes away their reason; and furious, they grasp their weapons....They prepare this powder from certain pods of the *yupa*...but the powder itself has the odour of strong tobacco. That which they add to it, through the ingenuity of the devil, is what causes the intoxication and fury--they put their shells [large snails] into the fire and burn them to quicklime...[which] they mix with the *yupa*...and after reducing the whole to the finest powder, there results a mixture of diabolical strength, so great that in touching this powder with tip of the finger, the most confirmed devotee of snuff cannot accustom himself to it, for in simply putting his finger which touched the *yupa* near to his nose he bursts forth into a whirlwind of sneezes. The Saliva Indians and other tribes...also use the *yupa*, but as they are gentle, benign and timid, they do not become maddened like our Otomacos who...before a battle...would throw themselves and, full of blood and rage, go forth to battle like rabid tigers."

The American ethnobotanist, Safford, identified the *cohoba* of the West Indies in 1916 (Safford 1916).

It was the British plant explorer Richard Spruce who in 1854 gave the earliest detailed report on the preparation and use of *yopo* snuff. He sent material of the pods and seeds for chemical study to the Royal Botanic Gardens at Kew, material

which was not analyzed until 1969 (Schultes; Holmstedt & Lindgren 1969). In these 120 - year old seeds, only bufotenine was found, whereas freshly collected seeds contained bufotenine with small amounts of N, N-dimethyltryptamine and 5-methoxy-N, N-dimethyltryptamine. Bufotenine has been reported to be hallucinogenically active by some investigators, while others have not been able to corroborate such activity.

Caesalpinia Linnaeus
Caesalpinia sepiaria Roxburgh, Hort. Beng. (1814): 32.

This plant is known in China as *yun-shih* and is said to be hallucinogenic. An early Chinese herbal reported that the "flowers could enable one to see spirits and, when taken to excess, cause one to stagger madly." And they may even cause, when ingested over a long period, to induce sensations of levitation and "communication with the spirits" (Li 1977).

Canavalia Adanson
Canavalia maritima (Aubl.) Petit-Thouars, Désvaux, Journ. Bot. 1 (1813): 80.

It is reported that, along the eastern coast of Mexico, this plants serves as a substitute of *Cannabis sativa.*

Seeds have been found in ancient graves im Mexico; there seems to be no other report of the use of the plant in modern cultures. In Peru, remains of this plant are found in sites dated 300 to 900 A.D. (Díaz 1975).

Cytisus Linnaeus
Cytisus canariensis (L.) O. Kuntze, Rev. Gen. Pl. 1 (1891): 177.

The use as an hallucinogen amongst the Yaqui medicine men of northern Mexico has been documented (Fadiman 1965).

The plant is native to the Canary Islands and was apparently an early introduction to Mexico.

Cytisine, common in the family, is the psychoactive priciple in *Cytisus canariensis*. Whether or not the effect is truly hallucinogenic has not been established. Further chemical and pharmacological studies of cytisine are warrented.

Mimosa Linnaeus
Mimosa hostilis (Mart.) Bentham, Trans. Linn. Soc. 30 (1875): 415.

The Pankarurú, Karirí, Tusha, Fulnio and other tribes of north-eastern Brazil formerly employed an intoxicating drink from the roots of a shrub, *Mimosa hostilis.* The drink, known as *vinho de jurema,* was the basis of the magico-religious *ajuca* ceremony which, with acculturation of the Indian groups, the Guegue, Acroa, Pimenteira and Atanaye, has become practically extinct. Use of *vinho de jurema* has, however, been reported to have survived amongst some Afro-American rituals in eastern Brazil (Lowie 1946).

The *jurema* cult is apparently ancient. An early report dated in 1788 and another of 1843 stated that the Indians under the influence of *jurema* "pass the night navigating through the depth of slumber" (Gonçalves 1946). Another description reports

that''...all celebrants...would see glorious visions of the spirit land, with flowers and birds. They might catch a glimpse of the clashing rocks that destroy souls of the dead journeying to their goal or see the Thunderbird shooting lightning from a huge tuft on his head and producing claps of thunder by running about.'' Still another report mentioned that ''the natives prepared a drink which brings on an enchantment, transporting them to heaven'' (Lowie 1946).

In 1873, botanical studies on *jurema* began. Several kinds of *jurema* were described (Gonçalves 1946). Later, in 1881, *jurema* was reported as a folk remedy of the hinterland peoples and that ''the Indians extract from *jurema* a certain kind of wine with delightful effects....''

Recently, in 1946, material of several ''kinds'' of *jurema* from northeastern Brazil were identified, each known locally by vernacular names: *jurema prêta* (*Mimosa nigra*), *jurema branca* (*M. hostilis*) and *M. verucosa*. It was the *jurema branca* that yielded the ''miraculous drink'' and acted as a stupefacient (Mors & Rizzini 1966).

An alkaloid isolated from the roots of *Mimosa hostilis* and initially called nigerine has been shown to be N, N-dimethyltryptamine (Gonçalves 1946; Pachter et al. 1959).

Much more research is needed on *vinho de jurema*: ethnographical (before all knowledge of the cult is forever lost) and chemicopharmacological. The active principle is said to be a tryptamine; the drink is reportedly prepared from the root of *Mimosa hostilis* with apparently no admixture. Tryptamines are not bioactive when taken orally, unless they are in the presence of a monoaminoxidase inhibitor. Until such an inhibitor is found in the preparation of *vinho de jurema*, the problem of how the brew can cause the hallucinations when taken orally without an additive supplyingthe inhibitor (or unless an inhibitor be found in the *Mimosa hostilis* material itself) remains a question unanswered.

Piscidia Linnaeus
Piscidia carthaginensis Jacquin, Enum. Pl. Carib. (1762) 27.

This plant is called *bois enivrant* (''intoxicating wood'') in Martinique.

Use of the crushed leaves cast into water as a fish poison is well reconized. Less well known, however, are its narcotic properties. According to a collector (*P. Diss 120B*, herbarium collection), the fruits are tonic and narcotic.

Active principles have not yet been reported from this genus, and its chemistry has apparently not been elucidated.

Sophora Linnaeus
Sophora secundiflora (Ort.) Lagasca ex DecCandolle, Cat. Hort. Monsp. (1813) 148.

In pre-peyote days in the American Southwest and northern Mexico, the natives employed the red beans of *Sophora secundiflora* as the basis of a vision-seeking cult. It was variously known as the Red Bean Dance, Witchita Dance, Deer Dance, Whistle Dance and Red Bean Society. The seeds were used ritualistically or as an oracular or divinatory medium for inducing visions in initiatory ceremonies and as a ritualistic emetic and stimulant. A number of North American tribes employed the bean: Apaches, Comanches, Delawares, Iowas, Kansas, Omahas, Otos, Osages, Pawnees, Poncas, Tonkawas and Witchitaws (LaBarre 1938 ; Schultes & Hofmann 1979).

Well-dated archaeological finds in northern Mexico and adjacent Texas suggest that *Sophora secundiflora* may have been ceremonially employed as early as the ninth millennium BC. These beans have been found in levels spanning a period of 8120 BC to 1000 AD. Since the beans are not food and as they were found often in abundance and in association with *peyote*, it is assumed that their use was in some kind of hallucinatory ritual (Adovasio & Fry 1976).

The active principle in *Sophora secundiflora is the highly toxic alkaloid cytisine (Raffauf 1970). This alkaloid affects the phrenic nerve controlling the diaphragm, and deaths from respiratory collapse occasionally happened during the ceremony. When peyote*, from all aspects a safe hallucinogenic agent, came north and the *peyote* ceremony spread rapidly, the ingestion of the red bean and ceremonies surrounding its use gradually died out. However, the leader of the modern *peyote* ceremony usually wears a necklace of *Sophora* seeds as part of his dress–apparently a hold-over from the once sacred use of the red bean.

Zornia J.F. Gmelin
Zornia latifolia DeCandolle, Prodr. 2 (1825): 317.

The common name of this plant is *maconha brava* ("Wild marihuana"). An herbarium collection (*Prance, Rodrigues et al. 8917*) reports that the leaves are dried and smoked as an hallucinogenic substitute for *Cannabis* in coastal Brazil.

No psychoactive principle is known from *Zornia.*

Zygophyllaceae Caltrop Family
Peganum Linnaeus

Peganum harmala Linnaeus, Sp. Pl. (1753): 444.

Known as *Syrian rue*,this herb, native to dry regions from the Mediterranean east to Mongolia and Manchuria, has hallucinogenic principles, but its use as a definite narcotic has not yet been established (Schultes 1970, 1980). The high esteem in which the plant is held in folk medicine, especially in Asia, suggests that, in the past, it may have had a significant role–possibly as an hallucinogen--in religious ceremonies in India and elsewhere (Schultes 1970a; Porter 1962).

The seeds are rich in the known hallucinogenic alkaloids harmine and harmaline. The seeds have also been valued as a spice, and the fruits are the source of a red dye and a useful oil (Schultes & Hofmann 1980).

Erythroxylaceae

Erythroxylon[2] Linnaeus
Erythroxylon coca Lamarck, Encycl. 2 (1786): 393.
Erythroxylon coca Lamarck var. *Ipadu* Plowman, Bot. Mus. Leafl., Harvard Univ. 27 (1980) 49.
Erythroxylon novogranatense Hieronymus, Engler, Bot. Jahrb. 20, Beibl. 49, (1895) 35.

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2 According to the dictates of the International Rules of Botanical Nomenclature, the correct orthography of the generic name should be *Erythroxylum* P. Browne. This question has been elucidated by Plowman in Taxon 25 (1976) 141-144 and in *Botanical Museum Leaflets*, Harvard University 27 (1979) 45-68. I prefer, nevertheless, to use the much more widely employed and etymologically correct generic term *Erythroxylon*, which has been employed in all of the chemical and pharmacological and most of the botanical and anthropological literature.

Erythroxylon novogranatense Hieronymus var. *truxillense* (Rusby) Plowman, Bot. Mus. Leafl., Harvard Univ. 27 (1980): 56.

There can be no doubt that, with the exception of tobacco, the *coca* leaf represents the most important psychoactive plant of the New World. It is employed by millions of Indians in the Andes and western Amazon, and its active alkaloid, cocaine, has long been a valuable asset in Europe and the United States.

Recent research has clarified the botany of the source of *coca* leaves. It is now recognized that two species and two varieties are involved. *Erythroxylon coca* is wide-ranging, from Ecuador to Bolivia and northwest Argentina in the Andes; it occurs at 1500 and 6000 feet altitude in moist montane tropical forests on the eastern Andean slopes and wet inter-Andean valleys. *E. coca* var. *Ipadu* is a variety of the western Amazon of Brazil, Colombia, Ecuador and Peru; some evidence suggests that is a recent introduction, other that its use is of long-standing; but there is little doubt that it evolved from the highland *E. coca.* A more drought-resistant type of *coca* arose in northern Peru or southern Ecuador; It was described as *E. novogranatense* var. *truxillense* and evolved in the dry areas of northern Peru. It arrived early in the xerophytic parts of southern Ecuador and extended eventually southward in Peru and northward to the drier mountainous areas of Colombia, travelling even as far as Venezuela and, according to some reports, to Central America.

These several species and varieties vary in their chemical constitution, but all of them contain cocaine, the most important and the most significantly psychoactive of the numerous alkaloids of the genus. The alkaloids are of three basic types: derivatives of ecgonine, of tropine and of hygrine (Hegnauer 1966).

It has long been believed that the chewing of the *coca* leaf originally was a closely guarded privilege of the Inca nobility and other officials and that shortly before the Spanish conquest its use was extended to the general public, partly to increase work productivity. This belief has recently been questioned and has been termed a "myth". It is true, however, that its use greatly increased following the conquest: many writers attest to the expansion of *coca* chewing in daily life in the Andean region in the early colonial period.

Erythroxylon novogranatense and its variety *truxillense*--the so-called Colombian and Trujillo *coca*, respectively--do not cross with *E. coca* or, in the case of the latter, cross with difficulty. It is potulated that *E. novogranatense* var. *truxillense* originated directly from *E. coca* as an adaptation to drier conditions and that *E. novogranatense* itself developed from the variety *truxillense* (Plowan 1982a); it is especially much more tolerant. The earliest archaeological records of *E. novogranatense* are dated in the first millennium AD.

The botany of *Erythraxylon* has only recently been adequately clarified, especially by Plowan and his colleagues: "...botanical studies on *coca* have redefined the earlier, simplistic view that *coca* consisted of a single species--*E. coca*" (Plowman 1984).

Coca is consumed daily in the highlands of Peru, Bolivia, the northwesternmost part of Argentna and in parts of Colombia. The method of preparation and use varies little. The leaves are carefully dried. They are put into the mouth with an alkaline admixture, usually the ashes of *quinoa (Chenopodium quinoa)*, known in Peru as *llipta*. Other sources of the alkaline admixture, which is necessary for the extraction

of cocaine in the normally acid environment of the mouth, are employed in other regions where *quinoa* is not available: lime itself may be used when available.

What is very commonly overlooked or even purposely ignored in many governmental and sociological circles is the fact that *coca*, as chewed by the native, is not of necessity physically, socially and morally dangerous. Unwise legal prohibitions in certain Andean areas aimed at extirpation of the *coca* custom have invariably driven the Indian, deprived in his inhospitable cold altitudes, of the stimulant and euphoric *coca*, to the dangerously poisonous local distilled alcoholic drinks with an attendant rapid increase in crime. True addition, which can result from the use of pure cocaine, is not caused amongst the Indians who use only *coca* leaves.

In the highland areas, there is little vestige left of the sacred aura that once may have surrounded the plant. The leaves are chewed more or less habittually in daily life by people in many walks of life, especially by the Indians and many *mestizos*.

It is in the northwest Amazon that a semblance of sacredness survives--one of the reasons for believing that the *coca* custom is of long standing in that region. The variety cultivated there, *Erythroxylon coca* var. *Ipadu*, does not occur in the wild state.

The English plant-explorer, Spruce, wrote over 125 years ago that "I could never make out that the habitual use of *ipadu* [=*coca*] had any ill results on the Rio Negro, but in Peru [in the highlands] its excessive use is said to seriously injure the coats of the stomach, an effect probably owing to the lime taken along with it." The German ethnologist Koch-Grünberg, the only other scientifically oriented researcher to have spent long periods in the region until recent years, wrote simply that: "When used excessively, *coca* may be harmful to the nervous system."

Coca is prepared very differently for use in the Amazon than in the Andes. The leaves are carefully plucked each day by men, then toasted on a flat ceramic *cassava*-oven. When they are thoroughly dried and crisp, they are put into a large hollow trunk which serves as a mortar and pounded to a powder with a large pestle of a hard wood. The mortar measures four or five feet. The work of pulverization is done only by the men who carry it out rigorously in a standing position. It may take up a full hour of pouding. The dull, rhythmic thumping begins just at nightfall. In the meantime, leaves of *Cecropia sciadophylla* or less frequently other species of *Cecropia* or *Pourouma cecropiaefolia* are gathered and burned to ashes on the earthern floor of the Indian round house. The ashes are mixed with the *coca* powder in more or less equal quantity. This mixture is then very finely sifted. The resulting grey-green powder is placed in the mouth and, with the tongue, put above the gums. It is not chewed but slowly passes down the esophagus with saliva (Plowman 1981; Schultes 1987b.

A number of other plants may be added as "flavourings." The most interesting additive is the smoke of the resin from a tree, *Protium heptaphyllum*, which the Tanimuka Indians blow into small piles of the *coca* powder (Schultes 1957a).

The use of *coca* in the northwest Amazon is restricted to male members of the tribes. It is significant, too, that, while agriculture is the work of the women, only the men tend the *coca* fields, which are always separate from the general agricultural plot. Intensity of the use varies from individual to individual and from tribe to tribe.

Although *coca* seems to have an essential and semi-sacred role in sundry ceremonies, it is employed hedonistically in daily life. Some Indians will take *coca* only in the afternoon or evening, but many keep the powder in the mouth throughout their waking hours; some--especially amongst the Yukunas, one of the healthiest and most robust Indians of the Colombian Amazon--consume huge amounts.

In regions where acculturation has not changed native custom, a visitor or stranger is made welcome with an offer of *coca* powder by the head of the round house. A spatula made from the leg bone of the jaguar or a folded piece of the banana leaf are aboriginally used for transferring *coca* powder to the mouth, but now a metal spoon may be employed. A spoonful or two of the powder is put into the mouth; it is not chewed but is allowed gradually to mix with saliva and pass slowly into the stomach. When the dose is thus diminished, it is replenished with an additional dosage. Normally, a "quid" is kept in the mouth throughout the day.

Coca is used in several other ways in the northwest Amazon. The Tukanoan Indians of the Río Papurí take an aromatic decoction of *coca*--whether for medicinal purposes or not is still not known. The Panabos of Amazonian Peru drink *coca* on occasion "to lighten the body." There are vague reports, still not verified, that the Yukunas and Tanimukas of the Río Miritiparaná utilize *coca* powder in certain ceremonies as a snuff; there is no pharmacological reason to presume that it could not be active when taken in this way.

Erythroxylon coca var. *Ipadu* is not only planted, collected and treated in the northwest Amazon with particular respect, but the plant enjoys very special roles in certain ceremonies and enters into the origin myths of the tribes. The Tukanoans say that Sun Father was a *payé* ("medicine man") who originated the knowledge and power of modern *payes*. He had in his navel the powder of *viho*, the narcotic snuff prepared from *Virola*. A daughter of the Master of Game Animals owned *caapi*, the narcotic plant *Banisteriapsis caapi*. Pregnant and in great pain, she lay down. An old woman, in an attempt to help, took hold of her hand. The pregnant young woman broke her finger, but the elderly woman kept it and guarded it in the round house. A youth, however, stole it and planted it. The *caapi* vine grew from this finger. Another daughter of the Master of game animals, also pregnant and in intense pain, lay down. An old womam came to help, but this time the woman seized the girl's hand and broke off a finger. She buried it. The finger took root and grew into the first *coca* plant.

Similar legends from many tribes of the northwest Amazon concerning the supernatural and ancient origin of *Erythroxylon coca* var. *Ipadu* could be repeated; all bespeak great antiquity. Several tribes of the Colombian Vaupés, for example, say that their people originated from the Milk Way and arrived on earth in a canoe drawn by an anaconda; in the canoe were a man and a woman, the *cassava* plant, *coca* and *caapi* (Schultes 1981).

There are sundry substitutes for *coca* in the northwest Amazon. Probably a relatively large number of plants are involved, but only a few known and have definitely been identified. The Boras and Witotos, for example, use two wild species of *Erythraxylon* "when no *caca* is available". The Kubeos of the Colombian Vaupés may use *E. cataractarum*, a wild species, in lieu of real *caca*. Other plant species may be substituted, although all are considered to be inferior, when real *coca* is

not easily available. Furthermore, leaves of *E. coca* var. *Ipadu* are employed medicinally and enter into medicinal formulas in the northwest Amazon.

Archaeological material of *coca* has been reported from the late Preceramic period along the dry Peruvian coast. Indication of the use of *coca* as a chewed narcotic is found in the ceramic idols with distended cheeks--*coquero* figurines--found in Ecuador and dated about 1600 B.C. and records can be found in the ceramic lime pots from the Valdivia culture dated approximately at 200 B.C. It is thought that *coca* has been used in Ecuador for 5000 years. Gold artifacts of *coca* chewers from Tiwanaku indicate the use of *coca* there as early perhaps as the fourth century A.D. It has been suggested that the use of *coca* was introduced into Ecuador with the Inca conquest, but it is now certain that the chewing of these narcotic leaves is very ancient in Ecuador and that cultivation of *coca* may have begun on the eastern slopes of the Ecuadorian or Peruvian Andes, where *Erythroxylon* may have originated.

Erythroxylon coca can still be found wild in primary or secondary forests, and cultivated and wild populations interbreed freely. It differs from many cultivated plants in having been little changed in its morphology, genetics and chemistry by cultivation. The other three types of cultivated *Erythroxylon* are believed to have been derived from *E. coca* (Plowman 1979, 1982, 1982a).

It is extraordinary that the history, botany and ethnological studies of the use of one of the world's major psychoactive plants should have been neglected until such recent times. There is still much to be done in many fields impinging upon the aboriginal use of the species of *Erythrxylon*.

Malpighiaceae Malpighia Family

Diplopterys A. Jussieu
Banisteriopsis C. B. Robinson et Small
Tetrapterys Cavanilles

Banisteriopsis caapi (Spr. ex Griseb.) Morton, Journ. Wash. Acad. Sci. 21 (1931): 485.
Diplopterys cabrerana (Cuatr.) Gates, Brittonia 31 (1979): 109.
Tetrapterys methystica R. E. Schultes, Bot. Mus. Leafl., Harvard Univ. 16 (1954): 202.

In the western and southwestern Amazon of Bolívia, Brazil, Colombia, Ecuador and Peru and on the Pacific coastal region of Ecuador and Colombia, the Indians prepare a narcotic drink from the bark of the malpighiaceous *Banisteriopsis caapi* (Schultes 1957, 1986a). Occasionally, the drink may be made exclusively of this plant, but often various plant admixtures are used (River & Lindgren 1972). There is a list of more than twenty admixtures that may be added to the basic brew, but two are generally and most frequently employed. These two plant additives are the leaves of the malpighiaceous *Diplopterys cabrerana* and the leaves of the rubiaceous *Psychotria viridis* (Schultes & Hofmann 1980).

The narcotic drink prepared only from the bark of *Banisteriopsis Caapi* is psychoactive; it contains the β-carboline alkaloids harmine, harmaline and tetrahydro-harmine. When the leaves of either the *Diplopterys* or the Psychotria are added, the intoxication is greatly lengthened and heightened; both contain tryptamines.

Liana of *Banisteriopsis Caapi*. Cultivated in Fusugasugá, Colombia. Photograph: Schultes

Tryptamines are believed not to be actively psychotropic when orally ingested, unless they be in the presence of amino-oxidase inhibitors: the β-carbolines are amino-oxidase inhibitors (Schultes & Hofmann 1980).

Several malpighiaceous plants are reliably reported as the basis of hallucinogenic preparations, and they may well have similar chemical constitutions: amongst these are *Tetrapterys methystica* and *T. mucronata. The drink prepared from all of these species is locally known as ayahuasca (Peru and Ecuador), caapi* (Colombia and Brazil), *pindé* (Colombia) *natema* (Ecuador) or *yajé* (Colombia) (Schultes 1954, 1975).

An early report of *ayahuasca* appeared in Villavicencio's *Geografía del Ecuador* in 1858 (Villavicencio 1858). He identified the drug only as a vine employed by the Záparo and other tribes of the Río Napo. He detailed its use to "forsee and to answer...in difficult cases, be it to reply opportunely to ambassadors from other tribes in a question af war, to decipher plans of the enemy...and to take proper steps for attack and defense; to ascertain when a relative is sick, what sorcerer has put on the hex; to carry out a friendly visit to other tribes; to welcome foreign travellers; or, at last, to make sure of the love of their womenfolk."

Seven years earlier, in 1851, the British plant explorer, Richard Spruce had found the Tukanoan peoples of the Uaupés in Brazil using a liana called *caapi* to induce intoxication (Spruce 1873). He precisely identified the liana as a new species of *Banisteria*, later known as *Banisteriopsis caapi*. Spruce even collected in 1851 branches of the liana for chemical analysis, but no analysis was made of them until 1969. Again, when he entered the Ecuadorian Andes, he found the Záparos using *ayahuasca* and deduced that it was identical with the *caapi* that he has seen in the Uaupés (Schultes; Holmstedt & Lindgren 1969).

BANISTERIOPSIS *Caapi*

(Spruce ex Griseb.) Morton

Following Spruce's work, many writers, travellers, botanists and anthropologists have written about the drug, usually in a casual vein without adding musch of a botanial nature to the identification of the source.

The utilization and effects reported in various parts of the Amazon differ widely. The Tukanoans of the Río Vaupés in Colombia divide the effects of the drink into three stages: vomiting, diarrhoeia, sweating and an eventual sense of flying through the air, seeing at the same time brightly coloured lights, soon to be replaced by dancing accompanied by a kaleidoscopic series of *caapi*-images of a variety of geometric patterns. The next state is characterized by a disappearance of the geometric figures to be followed by sensations of flight and disappearance of space, accompanied by three-dimensional forms of animals and monsters. The natives interpret these visions as indicative of the validity of their origin myths. This second stage is characteristic of onc the deepest hallucinations, both visual and auditory: even singing can on accasion be heard. In the third and final stage of the intoxication, marked by brighter coloured visions, appearance of calmer visions in dull greens begins, and a period of pleasant, calming musical rhythms leading to a dreamy phase of peace takes place. According to anthropological studies, the Tukanoans believe that during a *caapi* intoxication, the individual may die and his spirit returns to the original womb, conceived as "an acceleration of time and an anticipation of death." The painting motifs associated by these Indians with *caapi* intoxication are interpreted as return to the "place of origin," "uterus" and "place of death." To be within the womb, the Tukanoans believe that they are beyond the Milky Way, whence their original ancestors came in a canoe drawn by an anaconda snake with a man and woman, the tapioca plant, the *coca* plant and the *caapi* plant (Reichel-Dolmatoff 1969, 1970).

Amongst the Tukanoan tribes of the Vaupés, *caapi* is taken in numerous ceremonies, especially in the famous annual Yuruparí Dance. But it may also be drunk for personal reasons on separate and individual occasions. The pricipal purpose of any use of *caapi* is, to these peoples, "the acquisition of knowledge, a knowledge that is expected to exist in the Otherworld" (Reichel-Dolmatoff 1975, 1978).

The Jívaro and other Indians of Ecuador and Peru believe that the drink can put one in communicatiom with the dead--the reason for one of the common names for the narcotic: *ayahuasca* or "vine of death." The physical condition of intoxication is due, according to their belief, to the departure of the soul from the body; when the soul returns, the inebriation ends. During its absence, the soul has visited departed ancestors (Harner 1972, 1973).

The natives of the northwest Amazon--especially the Tukanoan tribes along the Río Vaupés, recognize and have names for six or seven "kinds" of *caapi*. Most of these variants represent the same species and are taxonomically indistinguishable to the botanist: they may be chemovars, ecologically different individuals, from different parts of the liana or age forms (Schultes 1986).

Diplopterys cabrerana in forest near Mocoa, Putumayo, Colombia. Photograph: Schultes

Coriariaceae   Coriaria Family

Coriaria Linnaeus

Coriaria thymifolia Humboldt et Bonpland ex Willdenow, Sp. Pl. 4, part 2 (1806): 819.

This widespread, fern-like shrub of the highest Andes of South America is widely recognized as a highly poisonous plant. It is especially feared as a plant toxic to browsing animals, but there have been reported deaths of humans who have mistakenly eaten the fruits. It is stated, however, that some Ecuadorean natives eat the fruits to attain the sensation of flight and soaring through the air (Naranjo & Naranjo 1961).

The chemistry of *Coriaria* is still poorly understood, but it has been suggested that hallucinogenic effects are due to a glycoside, the chemical identity of which is still uncertain (Hegnauer 1973). The primary use of *Coriaria* in the Andes is as the source of a blue-black dye.

Sapindaceae   Soap-berry Family

Nephalium Linnaeus

Nephelium topengii (Merr.) H. S. Lo, Fl. Hainanica 3 (1974): 85.

In 1175 AD, a Chinese herbal reported that "lung-li grows in Ling-nan....The fruit...cannot be eaten raw but only afeter steaming....When eaten raw, it causes one to go mad or see devils" (Li 1977). It is probable that *lung-li* is a species of *Nephelium*, especially *N. topengii*, which has an edible fruit with toxic seeds.

There are 35 species of *Nephelium*, all Asiatic; two species occur in southern

China. Some of the species are known to be rich in cyanogenic glycosides and other toxic principles (Schultes & Hofmann 1979).

Ungnadia Endlicher

Ungnadia speciosa Endlicher, Atakt, Bot. (1833) t. 36.

There is archaeological evidence from Mexico and Texas that this plant may once have been ceremonially employed as a psychotropic drug in a magico-religious context (Adovasio & Fry 1976). There is no indication that any such usage has survived amongst contemporary natives.

The genus *Ungnadia* has only one species; it is called *monilla* or *Texas buckeye*. s seeds, containing cyanogenic compounds, are considered toxic.

Large caches of the seeds have been found in caves in northern Mexico and Texas, often in association with two known hallucinogens: the *peyote* cactus and the *red bean* or *mescal bean*. The oldest of these finds is dated at about 7900 BC, and the Texas buckeye beans occurred from that date to about 1000 AD. Such consistent association with *peyote* and the narcotic *mescal beans* might indicate that *Ungnadia* was possibly used in connection with *peyote* and *mescal beans*, especially since it could not be used as food and the seeds were often found in relatively large amounts.

There is in these archaeological excavations an apparent evolution in the use of psychoactive drugs--from the most toxic to the least harmful. It has been outlined as follows: "The earliest plants [in these sites] would appear to be the *buckeye* and the *red bean*, though the frequency of the former is much greater than the latter in early contexts. Later, the use of the *red bean* became more common, while the *buckeye* declined. At some point...the use of the *red bean* likewise declined, and *peyote* became the favored plant....there is a marked trend toward the use of even less lethal plants. *Ungnadia*, if indeed it be used as a psychotropic, is...quite dangerous, while *Sophora* [the *red bean*] is only a little less so. Conversely, *Lophophora*[*peyote*], even when taken in excess, is not physically harmful" (Adovasio & Fry 1976).

Malvaceae Mallow Family

Sida Linnaeus

Sida acuta Burman fil., Fl. Ind. (1768) 147.

Sida rhombifolia Linnaeus, Sp. Pl. (1753) 684.

Mexican soldiers have been reported to smoke the leaves of these two plants as an excitant and substitute for *marihuana*. *Sida acuta* is called *el macho ("the male")*, *S. rhombifolia* as *la hembra* ("the female"), a distinction based on the lenght of the floral stalks (Díaz 1975, 1976a). These species are called *chichipe*, *malva colorado* and *malva del platanillo* in Mexico.

Ephedrine has been reported from the genus (Raffauf 1970).

Cactaceae

A number of species of minor cacti are known as *peyote* or *hikuli* in northern Mexico, especially in the genera, *Astrophytum*, *Aztekium*, *Dolichothele*, *Leuchtenbergia*, *Mammillopsis*, *Obregonia*, *Solisia*, *Strombocactus*, *and others* (Flores 1975).

Ariocarpus Scheidweiler

Ariocarpus fissuratus K. Schumann, Engler et Prantil, Natürl. Pflanzenf. 3, 6a (1894): 195.

Ariocarpus retusus Scheidweiler, Bull. Sci. Bruxelles 5 (1838): 492.

Closely related to *Lophophora, Ariocarpus*--especially *A. retusus* and *A. fissuratus,* both known as "false *peyotes*"--are considered by the Tarahumare Indians to be "stronger" than *Lophophora.* Consumed in the fresh state, they are taken as stimulants to runners. The Huichol Indians consider *A. retusus* to be evil, as it will drive people mad if ingested. The Tarahumare apparently do not use *A. retusus,* since the after-effects of its intoxication are so unpleasant and long-lasting.

Hordenine and other phenhylethylmine alkaloids have been isolated from both of these species of *Ariocarpus* (Braga & McLaughlin 1969; Neal et al. 1972).

Ariocarpus retusus, Huichol Indian country, northern Mexico. Photograph: P. T. Furst.

Carnegiea Britton et Rose

Carnegiea gigantea (Engelm.) Britton et Rose, Journ. N. Y. Bot. Gard. 9 (1908): 188.

The one species of this genus--the largest of all cactus plants--has long been used by Indians of the American Southwest and of Mexico for food, drink and other purposes. Known as *saguaro*, it was early reported as the source of a wine, a use still common. It is also considered to be medicinal: The Seri Indians, for example, treat rheumatic pains with it (personal observs).

While there is no ethnobotanical report of the hallucinogenic use of *saguaro*, it contains alkaloids believed to be psychoactive--carnegine, gigantine and norarnegine; trace amounts of 3-methoxytyramine and a still uncharacterised alkaloid have also been isolated from the plant (Kapadia et al. 1970; Bruhn & Lundstrom 1976).

Coryphantha (Engelm.) Lemaire

Coryphanta spp.

Coryphantha compacta (Engelm.) Britton et Rose, *The Cactaceae* 4 (1923): 36.

Coryphantha macromeris (Engelm.) Lemaire, *Cactees* (1868): 35.

Coryphantha palmeri Britton et Rose, *The Cactaceae* 4 (1923): 39.

Little is known concernig aboriginal use of *Coryphantha* amongst the Tarahumares. The genus, however, is rich in phenylethylamine and other alkaloids (Bruhn & Agurell 1974; Sato et. al. 1973: Hodgkins et. al. 1967; Schultes & Hofmann 1980). The genus *Coryphantha* stands out as a fertile group for ethnobotanical, chemical and pharmacological study.

The Tarahumare recognize this species as a kind of *peyote*, calling it *wichuri*. They consider it a potent medicine used by the shamans; it is greatly feared by the general population. It is called also bakana or bakanawa, the names applied to the presumably hallucinogenic *Scirpus* (Bye 1976).

Known locally as *donana* (Doña Ana) in Mexico, it may still be employed as an hallucinogen.

The principal active constituent is macromerine. Animal testing has indicated potential hallucinogenic activity of this alkaloid; it is structurally related to mescaline and epinephrine (Hodgkins et al. 1967).

Coryphantha macromeris (Engelm.) Lemaire var. *Runyonii*, Britton et Rose.

The principal constituent of this variety is normacromerine. Further research has revealed, for the first time in the Plant Kingdom, the presence of N-methylmetanephrine and metanephrine and the first time of synephrine and N-methyltyramine in this genus (Schultes & Hofmann 1980).

Coryphantha palmeri Britton et Rose.

This cactus has been reported as a source of the hallucinogenic macromerine, but there has been no substantiated indication that the plant is employed in native

medicine (Hodgkins 1967; Dominguez et al. (1970); Schultes & Hofmann 1980).

Echinocereus Engelmann

Echinocereus salm-dyckianus Scheer, Seemann, Bot. Herald (1856): 291.

Echinocereus triglochidiatus Engelmann, Wislizenus, Mem. Tours North Mex. (1948): 93.

The Tarahumare recognize two species of *Echinocereus* as kinds of *peyote:* E. Salm-Dyckianus and *E. triglochidiatus*, to which they attribute "high mental properties" (Bye 1976, 1979). In the latter species, there is the possibility of the presence of a tryptamine; a related species--*E. Merkeri*--phenylethylamines have been found. The Indians call them *pitallito.*

The chemistry of this genus is complex and is still under study, but an alkaloid possessing peripheral hypotensive effects similar to histamine has been isolated from it. A tryptamine derivative has also been attributed to the genus, and β-phenethylamine and hydroisoquinoline alkaloids have been found in some species (Agurell et al. 1969). Several of these constituents could be responsible for the psychoactive effects which natives claim for the cactus.

Epithelanthera Weber ex Britton et Rose

Epithelanthera micromeris (Engelm.) Weber ex Britton et Rose, *The Cactaceae* 3 (1922): 93.

The Tarahumare take *Epithelanthera micromeris* "to make the eyes large and clear to see sorcerers, to prolong life and to give speed to runners." It is ingested by shamans to induce visual hallucinations, but the Indians assert that it may cause permanent insanity (Bye 1976). The Tarahumare call this cactus *hikuli rosapari.*

The genus lacks chemical studies.

Lophophora Coulter

Lophophora williamsii (Lem.) Coulter, Contrib. U.S. Nat. Herb. 3 (1894) 131.

By far the most important hallucinogen of pre-Conquest Mexico was the *peyote* cactus: *Lophophora williamsii.* It may be called the prototype of New World hallucinogens because of its importance in primitive societies, its early attention from scientific investigators and the isolation of an alkaloid--mescaline--that has been found to have value in psychological research and psychiatric treatment.

The genus *Lophophora* has two species: *L. williamsii* and *L. diffusa*. The former grows in the dry, highland parts of central and northern Mexico and into Texas; the latter is known only from the Mexican state of Querétaro. Lophophora diffusa may not have been employed as an hallucinogenic agent, since its chemistry differs from that of *L. williamsii* in almost lacking the vision-inducing alkaloid mescaline. Mescaline offered, for the first time, the possibility of studying visual hallucinations produced by a pure chemical compound. *Lophophora williamsii* has 30% of its complex alkaloid content as mescaline.

The ceremonial use of *peyote* apparently goes back several thousands of

Peyote heads collected ceremonially by Huichol Indians in Mexico. Photograph: P. T. Furst

years. In a series of caves in Coahuila, Mexico, archaeological sites spanning about 8000 years of intermittent occupation, have yielded identifiable material, often in abundance, of *Lophophora williamsii*, in association with several other psychoactive plants (*Sophora secundiflora* and *Ungnadia speciosa)* (Adovasio & Fry 1976).

The earliest European reports hints that the Chichimecas and Toltecs knew *peyote* as early as 300 B.C.; although the accuracy of the dating may need rectification, the period is indeed early (Rouhier 1927).

The Spanish conquerors of Mexico were, for the most part, intolerant of pagan religious cults and, through repressive laws, diatribes and persecution, tried to extirpate these "diabolic practices." Sahagún wrote in the late 16th Century that those who eat *peyote* "see visions, either frightful or laughable; this intoxication lasts two or three days and then ceases; it...sustains them and gives them courage to fight and not feel fear nor hunger nor thirst; and they say that it protects them from all danger" (Sahagún 1938). He further reported that they "eat peyote, lose their senses, see visions of terrifying slights like the devil and were able to prophecy the future." He denounced *peyote* as embodyng "satanic trickery." In the same period, Hernández, physician to the king of Spain, who spent five years studying Aztec medicines in the field, wrote in his great tome on medicinal plants, animals and stones of "New Spain", that "both men and women are said to be harmed by it...Ground up and apllied to painful joints, it is said to give relief. Wonderful properties are attributed to this root [sic]. It causes those devouring it to be able to forsee and predict things...or to discern who has stolen from them some utensil" (Hernández 1651). The Spanish effort to stamp out *peyote* went so far that in 1760 a Catholic religious manual equated the eating of *peyote* to cannibalism.

In Mexico, the modern *peyote* hunt constitutes amongst the Huichols an annual trip to the deserts where the plant grows. It is ceremonially collected and dried for use throughout the year (Furst 1972).

During the last century--about 1880--Indians of the United States adopted *peyote* as a sacremental element in a new semi-Christian semi-aboriginal cult. The cactus was used in Texas, however, as early as 1760 and was known to American Indians during the Civil War. After 1880, the new cult spread rapidly, spurred on by missionary activity on the part of Plains Indians; the speed of its spread was due in part to the vision-seeking aspects of many of the tribal characteristics but also in great part to its reputation as a supernatural "medicine" (LaBarre & Schultes 1938).

It encountered fierce opposition in the United States from missionary groups, but eventually the cult was legally organized as the Native American Church which is said now to have more than 250,000 adherents in many tribes, even as far north as Canada. Their supplies of *peyote* are procured in the form of dried *peyote* crowns, known as *mescal buttons*, sent legally through the postal service.

The ceremony in the United States, though more or less standardized, does vary somewhat from tribe to tribe. It consists of an all-night ritual, often in a

A painting by a North American Indian of a peyote ceremony in Oklahoma. Property of Botanical Museum of Harvard University

teepee or special permanent building, with singing, chanting meditation, prayer and frequently a short "sermon" by the roadman or leader, ending in the morning with a communal meal. There is sometimes a curing during the night (LaBarre 1938).

As many as 25 or 30 or more mescal buttons may commonly be consumed by one worshipper during the night. The intoxication is characterized by a kaleidoscopically moving series of the most brilliantly coloured visions. These visions are caused by one of the more than 30 alkaloids of two series (phenylethylamines and isoquinolines) contained in the plant--mescaline. Other hallucinations--especially auditory--are experienced during the intoxication, which tend to have two phases: a period of contentment and hypersensitivity followed by one of nervous calm and muscular sluggishness, usually with hyper-cerebrality and visions. The visual hallucinations seem to follow a sequence from geometric figures to familiar scenes and faces, to unfamiliar scenes and often a variety of unfamiliar objects. There are no reports available about the various other hallucinogenic effects of the large number of minor alkaloidal constituents (Kapadia 1970).

Mescaline has been employed in psychiatric research. The intoxication induced by mescaline alone, however, is very different from that brought on by eating the *mescal button* with its more than 30 alkaloids, all or most of which are probably in some way physiologically active.

While the visions are usually important, especially amongst the Plains tribes where the vision-quest is deeply rooted, *peyote* is revered in great part because of its appeal as a "medicine" and stimulant. *Peyote* may have medicinal properties as understood in Western medicine, since antibiotic activity has been found in the plant. Its supernatural "medicinal" powers, however, seem to stem

from its bizarre visual hallucinations which, in native belief, are able to put man into cantact with the spiritual world of other realms from which it is held come illness and even death and to which the medicine-man may turn for diagnosis and treatment of many ills (Schultes 1940).

In Mexico especially, the magico-religious reputation of this cactus have such repute that many other plants are given the same or very similar names--not only numerous cacti but also species in other families, including the composites, legumes, orpines, orchids, nightshades and others (Schultes 1937). It is the Cactaceae, however, that are, quite naturally, most closely associated in the Indian mind with *Lophophora*. Most of these cacti are known to be alkaloidal and potentially psychoactive, and they are aboriginally associated with *Lophophora* either because of some resemblance or because of their alleged or actual toxic effects.

Mammillaria Haworth

Mammillaria Craigii Lindsey, Cact. Succ Journ. 14 (1942) 107.

Mammillaria grahamii Engelm. var. Oliviae (Orcutt) L. Benson, *Cacti of Arizona* (1969) 22.

The Tarahumare consider *Mammillaria craigii* a sacred plant. After removing the spines, the shamans eat the flesh in special ceremonies. It induces sleep, during which they see brilliant colours and travel far and wide. These Indians fear that mistreatment of the plant is dangerous; the Tarahumare name for the cactus--*wichuri*--is believed to be related to their term for insanity-- *wichuwa-ka* (Bye 1976, 1979). *Mammillaria Heyderii* is known also as *witkulik.*

An alkaloid--N-methyl, 3-4-dimethoxyphenylethylamine--has been isolated from *Mammillaria Heyderii*, a species very closely related to *M. Craigii* (Bruhn & Brunh 1973).

Several other species of *Mammillaria*, as yet unidentified, are similary reported as false *peyotes* amongst the Tarahumare.

Another kind of *hikuli* or *peyote* in the Tarahumare country is *Mammillaria grahamii* var. *oliviae*. After the spines are removed, the top of the cactus is eaten, causing drowsiness during which the native "travels" with bright lights. Shamans use it in certain ceremonies. It is believed also to be dangerous if improperly treated, inducing insanity (Bye 1976, 1979).

This species has not been chemically analyzed.

Neoraimondia Britton et Rose

Neoraimondia macrostibas (Schum.) Britton et Rose, The Cactaceae 2 (1920): 181.

This cactus of the central Andes is one of the ingredients of the hallucinogenic drink *cimora* prepared basically from the cactus *Trichocereus Pachanoi*, a mescaline-rich species.

Apparently no chemical studies of Neoraimondia have yet been carried out to ascertain whether or not it contributes bioactive constituents to the *cimora* preparation.

Pachycereus (A. Berger) Britton et Rose
Pachycereus pecten-aboriginum (Engelm.) Britton et Rose, Contrib. U. S. Nat. Herb. 12 (1909): 422.

The large, columnar cactus, *Pachycereus pecten-aboriginum*, is prepared in a drink called *cawé* or *chawé* by the Tarahumare. The drink is taken ceremonially to induce *peyote*-like effects such as dizziness and visual hallucinations (Bye 1976; Pennington 1963).

Four alkaloids occur in this plant, the principal one being salsolidine (Agurell 1969; Agurell et al. 1971; Bruhn & Lindgren 1976; Spath 1969).

Pelecyphora Ehrenberg
Pelecyphora aselliformis Ehrenberg, Bot. Zeit. 1 (1843): 737.

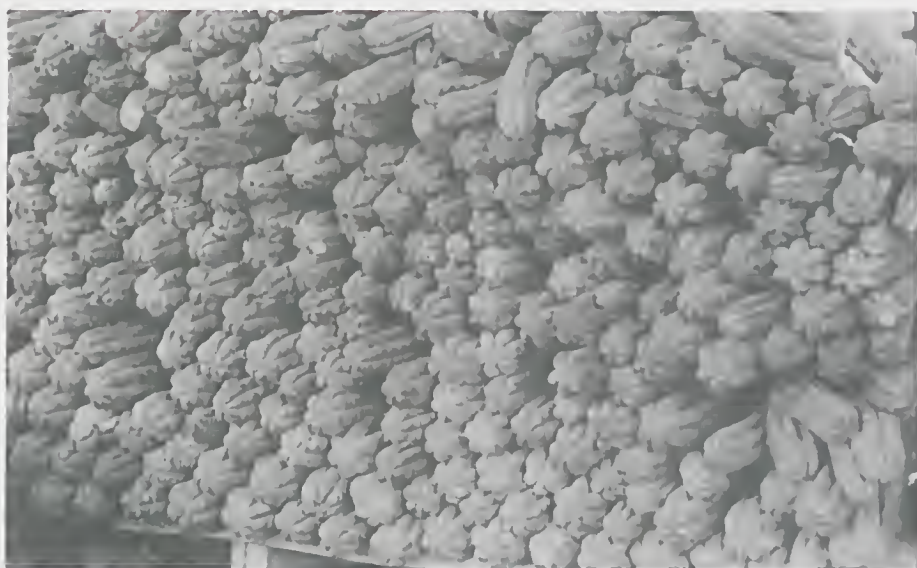
Pelecyphora aselliformis is a small, beautiful, spineless cactus, known in Mexico as *peyote* or *peyotillo*. Sold in markets for its presumed febrifugal and anti-rheumatic properties, it has several phenylethylamine and isoquinoline alkaloids, including traces of mescaline, but there is no report of its being used as an hallucinogen (Agurell et al. 1971; Bruhn & Bruhn 1973; Crosby & McLaughlin 1973; Poisson 1960).

Trichocereus (Berger) Riccobono
Trichocereus pachanoi Britton et Rose, The Cactaceae 2 (1920): 134, t. 196.

Trichocereus pachanoi, of the central Andes of Bolivia, Ecuador and Peru, represents one of the hallucinogenic plants of most ancient use in South America. It is known generally as *San Pedro;* in Peru, it is called *huachuma;* in Bolivia, achuma; in Ecuador, *aguacolla* or *gigantón*.

The oldest archaeological evidence is dated at 1300 B.C. Chavin textiles, almost equally as old, and ceramic vessels depict the cactus together with the jaguar and humming birds. A whole series of archaeological records coming down to Nazca culture from 100 B.C. to 500 A.D. depict the cactus (Sharon 1978).

When the Spaniards arrived, the use of *Trichocereus* in Peru was well established. The missionaries actively persecuted the *San Pedro* cult: "This is the plant," wrote one, "with which the devil deceived the Indians...in their paganism, using it for their lies and superstitions...those who drink lose consciousness and remain as if dead....Transported by the drink, the Indians dreamed a thousand absurdities and believed them as if they were true" (Sharon 1972).

The cult as now practiced is an amalgam of pagan and Christian elements: the name *San Pedro* is believed to have been applied to the cactus because it holds, like Saint Peter, the keys to heaven. The rituals surrounding its use are heavily moon-oriented and are now employed to cure a variety of ills from alcoholism to insanity; it is also valued in divination, to counteract witchcraft and sorcery (Friedberg 1963). The magical powers of *San Pedro* transcend curing and divination: it is believed to be able to guard houses, for example, by whistling in an unearthly way, striking terror into the hearts of thieves and forcing them to flee. Many patients with serious

Pieces of the San Pedro cactus, *Trichocereus Pachanoi*, for sale in native market in northern Peru. Photograph: C. Friedberg.

ailments make long pilgrimages to special shamans in holy places near lakes in the high mountains (Sharon 1978).

Shamans distinguish four "kinds" of the cactus and distinguish them by number of ribs. The individuals with four ribs are very infrequently found and are considered to be endowed with the most potent supernatural powers. Short pieces of the stem of *Trichocereus pachanoi* are sold in native markets. They are boiled in water for as long as seven hours. The drink is often taken with the addition of other herbs, in which case it is known as *cimora*. Many of the additives--eg., the cactus *Neoraimondia marcrostibas*, *Isotoma longiflora*, *Pedilanthus tithymaloides* and *Brugmansia aurea* or *B. sanguinea*--may themselves have highly active constituents (Dobkin de Ríos 1977). Frequently, magic calls for the addition of other elements such as powdered bons and dust from graveyards. Magical flight it typical of today's *San Pedro* ritual; Indians believe that they are carried across time and distance. The shaman may take the potion himself or with the patient: his aim is to make the patient "bloom" during the night ceremony in order that his subconscious may "open like a flower" like the night-blloming *San Pedro* cactus.

There are some 40 species of *Trichocereus* in South America; at least 25 are alkaloidal, some containing mescaline. *Trichocereus pachanoi*, which occurs only between·6000 feet, has a relatively high concentration of mescaline (2% of dried material) and some seven other alkaloids (Raffauf 1970; Poisson 1960; Hegnauer 1964).

Lythraceae Loosestrife Family

Heimia Link et Otto

Heimia salicifolia (HBK.) Link et Otto, Enum. Pl. 2 (1822): 3.

Heimia salicifolia, known vernacularly in Mexico as *sinicuichi*, represents one of the poorly understood New World hallucinogens.

The leaves, slightly wilted, are crushed in water which is allowed to ferment in the sun. The resulting drink has a mildly intoxicating effects, characterized by a feeling of giddiness followed by a drowsy euphoria and darkening of the surroundings, shrinking of the world around, altered perception of time and space, removal from a state of reality and auditory hallucinations. The natives believe that *sinicuichi* has sacred or supernatural powers and that it helps them recall events of many years back as if they had taken place yesterday; some say that they are enabled to recall even prenatal happenings! (Reko 1936).

The alkaloids of *Heimia salicifolia* are quinolizidines. Seven are present in the plant, but cryogenine seems to have the most significant pharmacological activity, as it mimics qualitatively the activity of the extract of the plant (Tyler 1966).

Umbelliferae Parsley Family

Peucedanum Linnaeus

Peucedanum japonicum Thunberg, Fl. Jap. (1784): 117.

This stout perennial herb, called *fang-k'uei*, is well known in Chinese traditional medicine (Li 1977). It is reported to be valued as a diuretic, eliminative, sedative, tonic and tussic, even though its use is believed to be harmful to the health. A Chinese writer in 510 A.D. states that "feverish people should not take it, because it causes one to be delirious and see spirits." Another Chinese writer reported that its hallucinogenic effects were due to admixtures: *Aconitum* and *Euphorbia*. There is no evidence that *fang-k'uei* was used purposefully as an hallucinogen.

Coumarin derivatives are common in the genus and are known from *P. japonicum*, but these constituents do not appear to be hallucinogeic.

Siler Miller

Siler divaricatum Bentham et Hooker fil. Gen. Pl. 1 (1867): 909.

The one species of the genus *Siler* native to Europe and northern Asia has been mentioned in early Chinese literature, under the name *feng-feng*, as a possible hallucinogen: "The root is spicy and non-poisonous; the kind that bifurcates at the top produces madness" (Li 1977).

Several old Chinese herbals recommend the root of this plant as an antidote for aconite poisoning.

Psychoactive principles have not been reported from *Siler*.

Ericaceae Heath Family

Pernettya Guadichaud

Pernettya parvifolia Bentham, Pl. Hartweg. (1846): 219.

There are several reports that *Pernettya* is toxic. The fruits of *P. parvifolia* of Ecuador, where it is called *taglli*, cause hallucinations and other psychic and motor alterations (Naranjo 1969).

Pernettya furens (Hooker ex DC.) Klotsch, Linnaea 24 (1851): 83.

Pernettya furens is known as *hued-hued* and *hierba loca* in Chile, where the fruits are recognized as toxic, causing mental confusion, madness and even permanent insanity. In excessive doses, they induce an intoxication similar to that following ingestion of *Datura* (Manske 1931).

It is presumed that the active principle of *Pernettya* is andromedotoxin. There is little evidence that *Pernettya* has been purposely employed as an hallucinogen, but it has been suggested that aborigines have had magico-religious uses of the fruits of these shrubs.

Vaccinium Linnaeus

Vaccinium floribundum Humboldt, Bonpland et Kunth, Nov. Gen. et Sp. 3 (1816): 266.

This species is known in Venezuela as *borrachero*, suggesting that it is psychoactive (*Steyermark 104845;* herbarium specimen).

Desfontainiaceae Desfontainia Family

Desfontainia Ruiz et Pavón

Desfontainia spinosa Ruiz et Pavón, Fl. Peru. Chile 2 (1799): 47.

This genus of four species and several varieties of low trees or shrubs is sometimes placed in the family Loganiaceae. *Desfontainia spinosa* inhabits the highest mountains from Costa Rica to Chile and Argentina. It is known to be employed psychoactively in two far-distant localities: Chile, where the Mapuche Indians take it as a narcotic (Mariani 1965), and southern Columbia, where the medicine-men make a tea of the leaves ''when they want to dream'' or ''to see visions and diagnose diseases'' (Schultes 1977). The tea is so potent that, to one medicine-man, they ''go crazy'' under its influence. Because of its potency, it is used only for the ''most difficult'' cases of diagnosis. This species is called *borrachero* or *borrachero de páramo* in Colombia; *chapice*, *michai blanco*, *taique* or *trautrau* in Chile.

Chemical studies of this species are still underway. There are indications from spot-tests that the plant has alkaloids; since the family is so closely allied to the alkaloid-rich family Loganiaceae, *Desfontainia* should be expected to have alkaloids.

Apocynaceae Dogbane Family
Alstonia R. Brown

Alston venenata R. Brown, Mem. Wern. Soc. 1 (1809): 77.

In southern India, this species is recommended in the Ayurvedic system of medicine for the treatment of insanity and epilepsy. Definitive reports of its use as an hallucinogen are not available, but the shrub is rich in indole alkaloids, two of which have been shown to possess interesting psychotropic activity (Bhattacharya et. al. 1975).

Convolvulaceae   Morning Glory Family

Ipomoea Linnaeus and *Turbina Rafinesque*
Ipomoea violacea Linnaeus, Sp. Pl. (1753): 161.
Turbina corymbosa (L.) Rafinesque, Fl. Tellur. 4 (1838): 81.

The early Spanish chroniclers of conquered Mexico reported of the sacred seeds of a morning glory known as ololiuqui. They came from a vine with cordate leaves and small round black seeds called in Nahuatl *coaxiluitl* or "snake plant." For several centuries, the identity of *ololiuqui* was in doubt, notwithstanding excellente descriptions and ilustrations of the plant in a variety of the early Europenan writings. Identification had to wait until the early part of this century (Urbina 1897, 1903), and it was not until the 1930's that authentic botanical material collected amongst the Mazatecs of Oaxaca established beyond any doubt that the seeds are those of *Turbina corymbosa,* known formerly as *Rivea corymbosa* (Reko 1934; Schultes 1944).

Ololiuqui (*Rivea corymbosa*), as illustrated in the Paso y Troncoso edition (Codex Florentino) of Sahagún: *História de las Cosas de Nueva España.*

A second morning glory has recenty been identified as an hallucinogen used amongst the Zápotecs of Oaxaca--the seeds of *Ipomoea violacea*, known locally as *badoh negro* (Wasson 1962).

Both of these morning glories owe their hallucinogenic activity to ergoline alkaloids. The seeds of both plants have very similar chemical contents, but the total alkaloid content of *Turbina corymbosa;* is 0.012%, whereas *Ipomoea violacea* contains 0.06% the reason for the natives' using in their ceremonies smaller quantities of seeds of the latter species than of the former (Hofmann & Tscherter 1960).

A Spanish report dated from 1615 stated that "...it will not be wrong to refrain from telling where it [*ololiuqui*] grows, for it matters little that this plant be here described or that Spaniards be made acquainted with it" (Hernández 1651). Another record of the same period said that "...when it is drunk, this seed deprives of his senses him who has taken it, for it is very powerful" (Shagún 1938). Other references explained that many things in Mexico (springs, rivers, mountains, *ololuiqui*, etc.)" have their deities. *Ololiuqui*...deprives those who use it of their reason...The natives communicate in this way with the devil, for they usually talk when they become intoxicated with *ololiuqui*, and they are deceived by various hallucinations which they attribute to the deity which they say resides in the seeds..." Still another chronicler wrote in 1634 that an Indian penitent in confession said: "I have believed

Chinantec medicine man. Yolox, Oaxaca, Mexico. Photograph: Schultes.

in dreams, in magic herbs, in *peyote* and in *ololiuqui*, in the owl, etc." A further report explained in part that "they place offerings to the seeds...in secret places so that the offerings cannot be found if a search be made. They also place these seeds amongst the idols of their ancestors....They do not wish to offend *ololiuqui* with demonstrations before the judges of the use of the seeds and with public destruction of the seed by burning" (Schultes 1941).

Seeds of *Turbina corymbosa* are used at the present time by most tribes of the Chinantla, the northeastern part of Oaxaca. The Mazatecs and Chinantecs, especially, esteem this hallucinogen. In Oaxaca, it is customary to grind the seeeds on a metate. The resulting powder is soaked in cold water which is strained through cloth and drunk. The ceremonial use of *Turbina corymbosa* is very common, at least in the hills of northeastern Oaxaca. As one writer has said: "To-day, in almost all the village of Oaxaca, one finds the seeds still serving the natives as an ever present help in time of trouble" (Wasson 1962).

There was little interest in *Turbina corymbosa* until the 1950's, when a psychological paper by Humphrey Osmond appeared--containing the first psychiatric self-experiment with intoxication from the seeds (Osmond 1955). The chemical constitution of these seeds was not clarified until the 1960's when Hofmann, discoverer of LSD, elucidated the active principles of this morning glory; prior to his work, no hallucinogenic compounds were known to exist in the Convolvulaceae (Hofmann & Tscherter 1960).

It has been suggested that the *tlitliltzen* of the ancient Aztecs was *Ipomoea violacea* (Wasson 1962). Amongst the Zápotecs, the long angular black seeds must be collected by the person who is to take them. A young girl or boy must assist in the administration of the drink prepared from the seeds and must listen to the words uttered by the patient during his period of intoxication. The patient will, through the power of the seeds of *badoh*, be enlightened as to the cause and cure of his problem; he will be told whether his trouble is actual illness or maliciously induced witchcraft (Wasson 1963).

·Labiatae Mint Family

Coleus Loureiro

Coleus blumei Bentham, Lab. Gen. et Sp. (1832): 56.
Coleus pumilus Blanco, Fl. Philip., Ed. 1 (1837): 482.

There is some evidence that two species of *Coleus--C. blumei* and *C. pumilus*, both Old World introductions, may be employed by the Mazatecs in much the same way as *Salvia divinorum* (Wasson 1963). The psychoactive properties have not been experimentally tested as yet, nor has chemical investigation been carried out on *Coleus*, at least on Mexican-grown material.

Lagochilus Bunge

Lagochilus inebrians Bunge, Mem. Sav. Etr. Petersb. 7 (1847) 438.

The narcotic effects and the extent of use of this mint are not fully known. From early times, Tajik, Tartar, Turkoman and Turkestan tribesmen have used a tea

prepared from the toasted leaves of *Lagochilus inebrians*, a small shrub of the dry steppes of southern Russia, as an intoxicant (Schultes & Hofmann 1980). The stems, fruiting tops and flowers are often used together with the leaves. Honey or sugar may occasionally be added to lessen the bitter taste of the mint.

Lagochilus inebrians has been included in the Russian pharmacopoeia, recommended in an infusion or tincture as an anti-hemorrhagic or for its hemostatic properties, to reduce permeability of blood vessels and as an aid in blood coagulation; it has likewise been recommended in Russia for use in the treatment of certain allergies and dermatological conditions. Reports have recommended its effectiveness in treating nervous disorders, as an hypotensive, anti-spasmodic and sedative agent (Schultes & Hofmann 1980).

Chemists isolated a crystalline compound which they called lagochilene, a diterpene (Chizhov et al. 1969). There is apparently no report of a potentially hallucinogenic or psychoactive constituent in the plant, but further ethnobotanical and pharmaco-chemical studies are needed.

Salvia Linnaeus

Salvia divinorum Epling et Jávita-M., Bot. Mus. Leafl., Harvard Univ. 20 (1962) 75.

The Mazatec Indians of Oaxaca, Mexico, value the leaves of this *Salvia* in their divinatory rites, especially when more potent hallucinogens, such as mushrooms and morning glory seeds, are not available. The leaves are chewed or crushed and mixed with water to be drunk. Known to virtually all Mazatec families, the plant is cultivated in secret plots away from home sites. It is reproduced by breaking off a shoot and sticking it into the soil at altitudes of 5000 feet; it seems never to be found in a wild state, indicating perhaps that it has had a very long history as a cultivated plant (Wasson 1962).

Like most mints, *Salvia* is rich in essential oils. No hallucinogenic principle has as yet been found in *S. divinorum*, but its psychoactivity has been experimentally substantiated. There are also numerous actual medicinal uses of this mint amongst the Mazatecs; although only weakly psychotropic, the *Salvia* infusion will induce powerful visions under the appropriate circumstances.

There are many folk-medicine uses of *Salvia* around the world. Actually, the term *Salvia* stems from a Latin word meaning "to be of good health."

This psychoactive *Salvia* is locally known as *hojas de la Pastora, hierba de la Virgen* and *ska-Pastora.*

Chemical studies have not yet revealed a psychoactive constituent, despite positive experimental evidence of its psychoactivity.

Solanaceae Night-shade Family

Brugmansia Persoon

Brugmansia aurea Lagerheim, Bot. Jahrb. 20 (1895): 664.

Brugmansia arborea (L.) Lagerheim, Bot. Jahr. 20 (1895): 663.

Brugmansia sanguinea (R. et P.) D. Don, Sweet, Brit. Fl. Gard. 2 (1835): 272.

Brugmansia suaveolens (H. et B. ex Willd.) Berchtold et Presl, Rosl. 2 Solanaceae (1823): 45.

One of the numerous atrophied forms of *Brugmansia aurea* cultivated by medicine men for use as an hallucinogen. Sibundoy, Colombia. Photograph: Shultes

There are several species of solanaceous shrubs or small trees, all psychoactive and employed in aboriginal societies of South America as hallucinogens, that are closely related to *Datura* and which were formerly referred to *Datura*. They are now believed to represent a distinct genus: *Brugmansia* (Schultes & Raffauf in press).

It is separated from *Datura* on morphological and biological grounds, although chemically both genera contain the same tropane alkaloids.

Several species have been widely distributed throughout the warmer parts of the world as cultivated ornamentals. While many species have viable seeds, the trees are propagated usually by vegetable means. Almost all tribes in the Andes and in the western Amazon Andean slopes employ *Brugmansia* eighter generally as an hallucinogen or as an adjunct to shamanism (Harner 1972, 1973; Cooper 1949).

Their native use as medicinal and hallucinogenic plants in South America must be very old. It has consistently been noted that all individuals of *Brugmansia* grow in locations where there had been human habitation. Furthermore, none of the species is known in the wild: all are cultigens. There are recognized six species: *B. arborea, B. aurea, B. sanguinea, B. suaveolens, B. versicolor* and *B. vulcanicola; two established hybrids are likewise known: B. x candida* and *B. x insignis.* They have numerous native names: *borrachero, haucacachu, huanto, chamico, campanilla, floripondio, maicoa, tonga* and *toa* (Bristol 1966, 1969).

One of the most widely cultivated species and one very commonly employed as an hallucinogen is the white-or yellow-flowered *B. aurea* which occurs in the Andes from Colombia to Chile. It has several local variants, including one with

Brugmansia vulcanicola in flower, one of the numerous species of hallucinogenic Brugmansias in the Andes. Volcán de Puracé, Cauca, Colombia. Photograph: Schultes.

golden-yellow flowers, most frequent in Colombia. Another recognized hallucinogen of ancient use is *B. sanguinea.* The seeds of this species were employed by the Chibchas of Colombia who administered them in a fermented drink, *chicha,* to the wives and slaves of dead warriors before they were buried alive to accompany their masters on the long trip. The Chibchas in northern Colombia use *B. sanguinea in* ceremonies at the Temple of the Sun at Sogamoza. Despite the introduction of Christianity to Peru, many Indian groups still maintain that *B. sanguinea* permits them to communicate with ancestors and others in the spirit worold; and some Peruvian Indian believe that this plant will reveal to them treasures preserved in archaeological sites, hence its local name *huacacachu* ("grave plant").

It is clear that Brugmansias are more widely employed as narcotics amongst South American Indians than is usually believed (Gleeson 1978). The preparation and use of *Brugmansia* differs from tribe to tribe, but most frequently it is administered in the form of pulverized seeds dropped into fermented beverages. An extremely toxic drug, it induces an intoxication characterized usually by initial effects so violent that physical restraint must be parcticed, until the partaker passes into a deep sleep-like stage, during which hallucinations are experienced.

Brunfelsia Linnaeus

Brunfelsia grandiflora D. Don, N. Edin. Phil. Journ. (1829): 86.
Brunfelsia grandiflora subsp. *Schultesii* Plowman, Bot. Mus. Leafl., Harvard Univ. 23 (1973) 259.
Brunfelsia chiricaspi Plowman, Bot. Mus. Leafl., Harvard Univ. 23 (1973): 255.

Brunfelsia grandiflora subsp. *Schultesii.* Cultivated near Leticia, Colombia. Photograph: Schultes.

In the northwest Amazon of colombia, Ecuador and Peru, these three species of *Brunfelsia* are employed as medicines and as hallucinogens. *Brunfelsia grandiflora* is also considered a cattle poison in Colombia and Bolivia and is employed as a fish poison in Ecuador (Plowman 1977).

These three plants are known in Colombia as *borrachero* ("intoxicant"). *Brunfelsia grandiflora* and *B. Chiricaspi* are wild; *B. grandiflora* subsp. *Schultesii* is cultivated.

The natives crush the stem or mash the leaves and drink the juice. It is drunk either alone or added to *ayahuasca* (*Banisteriopsis Caapi*) or to *yoco (Paullinia Yoco)*. The Kofáns call *B. grandiflora tsontinba-ko.* In the Siona language, the cultivated type is known as *huha-hai,* the wild type as *yai-huha-hai.* The effects of *yai-huha-hai* are described as extreme coldness and as a pain-killer; the Sionas recognize another type called *bi-a-huha-hai* which is preferred as an admixture with *ayahuasca.* Some tribes use these plants as medicines for treating rheumatism, snake bite, back pains and especially as anti-malarials. They all, when ingested, cause a sensation of Chills: the Ingano name *chiricaspi* means "chill plant."

Little is known of the chemical constitution of *Brunfelsia*. The principle that is hallucinogenic and that causes the feeling of intense chills has apparently not been found, although both effects have been experimentally experienced by botanical collectors and are reported by numerous Indian tribes.

Datura Linnaeus

Datura ceratocaula Jacquin, Hort. Schoenb. 3 (1798): 48.
Datura inoxia Miller, Gard. Dict. [Ed. 8] (1748) no. 5

The Indians of North America north of Mexico used several species of *Datura.* This virulently toxic genus of plants is still employed, especially in the American Southwest and Mexico; but in earlier periods, it was valued as far northeast as Virginia. The Algonquins of Virginia prepared a drink from a species of *Datura* called *wysoccan;* it may have been made of *D. Stramonium.* It was given to youths in initiatory rituals over long periods when they "became starks, staring mad, in which raving condition they were kept eighteen or twenty days" during which they "unlived their former lives" and entered into manhood by losing all memory of having been boys.

The species most commonly employed in the Southwest appears to be *Datura inoxia.* Many tribes utilize this plant ceremonially. The Zunis value it as an hallucinogen, anesthetic and medicine; it belongs exclusively to the Zuni rain-priests, the only men allowed to collect its roots. When they commune at night with the feathered kingdom, they put powdered roots into the eyes and chew the roots, seeking intercession for rain. This plant is the active part of the preparation employed in adolescent initiation rites in the Southwest. The Yumans take it to induce dreams and to gain occult powers. Many Indians believe that by taking the drug they can acquire the services of supernatural helpers and gain secret knowledge. Yokut boys studying to be shamans must undergo *Datura*-intoxication once a year.

In Mexico, the role of *Datura* is even more prevalent and significant. And the species presumably employed are more numerous: *D. inoxia* as well as probably

D. discolor, D. wrightii, D. kymatocarpa. D. pruinosa, D. quercifolia and *D. reburra* (Barclay 1959; Gleeson 1978).

The ancient Aztecs are believed to have valued a most unusual species of *Datura*--the aquatic *D. ceratocaula*--a sacred intoxicant. It was known as *sister of ololiuqui* (Schultes & Hofmann 1979).

From earliest pre-Conquest times, *Datura*--generically referred to in the vernacular as *toloache*--was widely used. Hernández, the Spanish physician who listed the therapeutic use of Aztec medicinal plants shortly after the Conquest, wrote about *toloatzin*, warning that excessive doses could drive a patient to a madness characterized by "various and vain imaginations." Even in modern times, the Tarahumare add *Datura* to their fermented maize drink to "make it strong" and ceremonially to induce visions. Modern Mexican Indians often consider *toloache* to be an hallucinogen inhabited, unlike the *peyote* cactus, by a malevolent spirit (Bye 1979).

All species of *Datura* (which formerly included *Brugmansia*)--both the New and the Old World representatives--contain as their active psychoactive principles tropane alkaloids: primarily scopolamine, hyoscyamine and lesser amounts of atropine (Evans & Wellendorf 1959; Hegnauer 1973).

Iochroma Bentham

Iochroma fuchsioides (HBK.) Miers, Hooker, Lond. Journ. Bot. 7 (1948) 346.

In the Valley of Sibundoy--an area of intense utilization of psychoactive plants-Indian medicine-men employ at least one species of the solanaceous genus *Iochroma*

Iochroma fuchsioides in flower. Botana, (near Pasto) Colombia. Photograph: Schultes.

as an hallucinogenic "medicine." This secies--*I. fuchsioides*--is locally known by the Kamsá Indian name *totubjansuch*. When used hallucinogenically by medicine-men, a handful of fresh bark rasped from the stem and an equal amount of the fresh leaves are boiled in water; the tea is then cooled and ingested with no admixture. One to three cupfuls taken over a three-hour periodo is said to be a dose for hallucinogenic effects (Schultes 1977a).

The plant is still used medicinally in Sibundoy; the root is valued in treating illnesses thought to require a strong purgative; it is likewise esteemed in treating colic, stomach-ache, difficulties with indigestion or bowel function and in cases of difficult child-birth.

According to informants, *totubjansush* was formerly more frequently used, but now medicine-men prefer to take *Brugmansia*, since the malaise resulting from *Iochroma* requires an unduly long period of recuperation. A sudorific tea prepared from the aromatic shrub *Hedyosmum translucidum* may be drunk to help lessen the after-effects of *Iochroma* intoxication.

Initial spot-tests have indicated that *Iochroma fuchsioides* is alkaloidal, but a detailed analysis, now underway, has not as yet benn published.

Latua Philippi

Latua pubiflora (Griseb.) Baillon, Hist. Plant. 9 (1888): 334.

In the coastal mountains of Chile between Valdivia and Chiloe, the toxic shrub or small tree *Latua pubiflora*, locally known as *latue*, is widely respected and feared by the natives (Murillo 1889). Medicine men formerly were believed to be able to induce a madness of an duration that they desired, according to the strength of the dose. The dosages were closely guarded secrets (Plowman et al. 1971).

The active principles are scopolamine and hyoscyamine (Raffauf 1970).

Methysticodendron R. E. Schultes

Methysticodendron amesianum R. E. Schultes, Bot. Mus. Leafl., Harvard Univ. 17 (1955): 2.

In the isolated mountain Valley of Sibundoy at 8000 feet in southern Colombia, the Indians vegetatively propagate a large number of what appears to be highly atrophied clones of *Brugmansia.* The medicine-men recognize them with a variety of native names and utilize them for divination, medical and hallucinogenic purposes (Schultes 1955).

A most atrophied form--so drastically altered that it is impossible to assign it with certainty to any species of *Brugmansia*--has been described as *Methysticodendron amesianum.* The Indians report that it is the strongest hallucinogen, and chemical studies have indicated that it has a high percentage of tropane alkaloids with a ratio of 80% of scopolamine, a probable explanation of its reputation as a most potent hallucinogen. It is a cultigen known only from the region of Sibundoy. It has been suggested as a virus infected *Brugmansia.*

Another reseacher suggested that might be "the action of a simple pleiotropic gene mutation...a monstrosity of some species of *Brugmansia* (Barclay 1959).

The local name of this plant is *culebra-borrachero* or *mits-kway-borrachero.* It has also been called a cultivar of *Brugmansia aurea* (Datura candida) (Bristol 1969).

This plant is extremely rich in scopolamine with minor alkaloids of atropine and two unidentified alkaloids. The total alkaloid content is 0.3% with a high ratio of scopolamine (Pachter & Hopkinson 1960; Theilkuhl 1957).

Solandra Swartz

Solandra guerrerensis Martínez, An. Inst. Biol. Univ. Mex. 37 (1967): 101, t. 4.

Another solanaceous genus, *Solandra, plays a role as an American hallucinogen. In Mexico, the Huichol Indians--and possibly other groups--drink the juice of the branchlets of several species, especially S. guerrerensis* and *S. brevicalyx as an inebriant with potent manifestations in mythology and symbolism. To these natives, it is one of their most sacred god-plants or kieli,* so powerful that they believe it can grant favours as an adjunct in witchcraft and sorcery and that anyone wronging the living plant may be permanently deranged. The visions produced are frightening--of snakes, wolves and venemous creatures (Knab 1977).

Much remains to be done before the chemistry of *Solandra* is fully understood, but preliminary studies indicate that a number of alkaloids, primarily tropanes, are present and cyanogenesis has also been reported from the genus (Evans et al. 1972).

Bignoniaceae Bignonia Family

Tanaecium Swartz

Tanaecium nocturnum (Barb-Rodr.) Bureau et K. Schumann, Martius Fl. Bras. 8, pt. 2 (1896): 186.

The Paumarí Indians of the western Amazon of Brazil prepare a psychoactive snuff from the leaves of this forest liana (Prance et al. 1977). The green leaves are shredded, toasted and pulverized, the sifted through a fine cloth. The powder is often mixed with tobacco. The Paumarí Indians call the drug *koribo.*

Medicine-men occasionally shuff this powder in treating their patients; and it

Floweing branch of *Methysticodendron Amesianum*, Sibundoy, Putumayo, Colombia. Photograph: Schultes.

is sometimes taken in rituals "to protect children" and in puberty rites for girls. Women drink *koribo* as a tea but do not use the snuff; the tea produces a drowsiness and inability to concentrate.

Field investigators have experienced the psychoactive effects of this plant merely from its odour which is due to the high concentration of cyanogenic compounds. Whether or not it is truly hallucinogenic has not yet been established, but there is no doubt that it has strong psychoactive effects.

The Karitiana Indians of Amazonian Brazil take a tea of the leaves of this vine mixed with a still unidentified legume as a remedy for diarrhaea, and the natives of the Chocó of Colombia attribute aphrodisiac properties to it.

The genus *Tanaecium* has seven species of tropical America and the West Indies. A species native to northern Colombia is extremely toxic to cattle. The genus is known to be rich in hydrogen cyanide in the fresh leaves. Fumes from the leaves may be toxic (Schultes & Hofmann 1980).

Acanthaceae   Acanthus Family

Justicia Linnaeus

Justicia pectoralis Jacquin var. *stenophylla* Leonard, Contrib. U. S. Nat. Herb. 31 (1958): 615.

The Waika Indians of Venezuela and northern Brazil dry and powder the leaves of this very aromatic herb to mix with a potently hallucinogenic snuff which they prepare from a resin-like liquid in the inner bark of *Virola* trees (Schultes and Holmstedt 1968). These Indians call the plant *masha-hari*. They state that this admixture is done to give fragrance to the *Virola*-snuff, but it is known that they sometimes make an intoxicating snuff from *Justicia* alone (Brewer-Carias & Steyermark 1976; Schultes 1989).

Further research in the field and laboratory is needed to explain its widespread use alone as an hallucinogen (Schultes 1939).

There are 300 species of *Justicia* in the tropics and subtropics of both hemispheres. Several species are employed in traditional medicine for rheumatism, colic and fevers. The type commonly cultivated for its aromatic leaves and as the source of a psychotropic snuff is a variety: *J. pectoralis* var. *stenophylla*.

The chemistry of this concept has been studied with conflicting results (Chagnon 1971; LeQuesne & Cook 1971; MacRae & Towers 1984). Further analyses are necessary, since it has now been established without any doubt that Indians frequently make an intoxicating snuff from *Justicia*, albeit it is said to be weaker than that prepared from *Virola* (Schultes 1989).

Teliostachya Nees

Teliostachya lanceolata Nees var. *crispa* Nees, Martius, Fl. Bras. 9 (1847): 72.

The Kokama Indians of Amazonian Peru, who know this variety as toé-negro, employ it as an hallucinogen and as an admixture to narcotic preparations (*Martin, Plowman and Lau-Cam, 1638*, herbarium specimen).

The psychoactive effects are said to last for three days, during which there is conversation with the spirit of the plant. Field reports state that this drug may cause loss of sight during this 3-day period.

Rubiaceae Madder Family
Pagamea Aublet

Pagamea macrophylla Spruce ex Bentham, Journ. Linn. Soc. 1 (1857): 110.

The leaves of this endemic shrub are dried and powdered by the Barasana medicine men in the Vaupés region of Colombia. A snuff prepared from the leaves is used during curing or divinatory ceremonies. Whether or not the snuff is psychoactive is not clear, and chemical examinations of the material have not been done (Schultes 1980).

Campanulaceae Bell Flower Family
Lobelia Linnaeus

Lobelia tupa Linnaeus, Sp. Pl., Ed. 2 (1763) 1318.

Native to the high Andes of Peru and Chile, this beautiful tall species of *Lobelia* with reddishn purple flowers is well known as a toxic plant (Mariani 1965). It is locally called *tupa* or *tabaco del diablo* ("devil's tobacco") (Ibáñez 1955). The Mapuche Indians of Chile smoke the dried leaves for the narcotic effects; they are also valued medicinally to relieve toothache. While it is not clear that the effects are truly hallucinogenic, they are definitely psychoactive.

It belongs to an alkaloid-rich family. The leaves of *Lobelia Tupa* contain lobeline, lobelanidine and norlobelanidine (Raffauf 1970); but none of these compounds is known to be psychoactive (Schultes & Hofmann 1980).

One North American species--Lobelia inflata, known as *Indian tobacco*, has been used medicinally by North American Indians and is now commercially important as a source of preparations used in smoking deterrents.

Compositae

Cacalia Linnaeus

Cacalia cordifolia Linnaeus fil., Suppl. (1781) 351.

This small shrubby climber is called *peyote* in Mexico, a name applied usually to the hallucinogenic cactus, *Lophophora williamsii.* While there is no indication that it has been employed for psychoactive properties, the use of this common name might be interpreted as a survival of a former status as an inebriant (Schultes 1937).

The chemistry of *Cacalia* is very complex. An alkaloid has been reported from *Cacalia cordifolia, but no constituents capable of inducing hallucinations are known from the plant (Raffauf 1970).*

Calea Linnaeus

Calea zacatechichi Schlechtendahl, Linnaea 9 (1834): 589.

A recently reported hallucinogen is a profusely branching shrub occurring from Mexico to Costa Rica: *Calea zacatechichi* (MacDougall 1968). The species name is derived from the Aztec name of the plant, meaning "bitter grass." It has been employed in folk medicine from earliest times, primarily as a treatment for fevers and diarrhoea; it has also been used as an insecticide (Schultes & Hofmann 1980).

The Chontal Indian medicine-men of southern Mexico, who believe that visions seen during the inebriation portend the future or aid in prophecy, state that the plant, which they call *thle-pelakano* ("leaf of god"), clarifies the senses. There is one indication that auditory hallucinations also are characteristic of the intoxication. An infusion of the dried leaves is slowly imbibed, after which the native lies down in a quiet place and smokes a cigarette of the dried leaves of the same plant. He knows that he has taken a sufficient quantity when he becomes drowsy and hears his own heart beat.

It has been suggested that an ancient Aztec inebriant known as *chichixihiutl* might have been *Calea zacatechichi.*

While no constituent capable of inducing visual hallucinations has as yet been found in this shrub, chemical studies with modern techniques are needed for a full understanding of the composition of this interesting plant.

Helichrysum Miller

Helichrysum foetidum (L.) Moench, Meth. (1794): 575.
Helichrysum stenopterum DeCandolle, Prodr. 6 (1838): 201.

Medicine-men in Zululand, South Africa, value these two species of erect, branching, strongly scented herbs "to get their trances." The fragrance of the plant material apparently is merely inhaled (*Gerstner 4828, 4821;* herbarium specimens).

Coumarine derivatives and diterpenes have been isolated from *Helichrysum,* but no actually hallucinogenic compounds are known in this genus (Gibbs 1974).

Senecio Linnaeus

Senecio hartwegii Bentham, Pl. Hartweg. (1839): 18.

In Mexico, several species of *Senecio* are known to have psychoactive constituents and are reported to be used (Díaz 1976; Schultes 1937). Especially important appears to be *S. Hartwegii,* locally called *peyote de Tépic;* but various other species go by the common name of *peyote,* which may indicate that the plants produce similar effects as those induced by the cactus, *Lophophora williamsii.*

It has been suggested that the ancient Aztec *guantlapatzintzintli* was *Senecio tolucanus,* which has an alkaloid capable of producing in animals analgesia, followed by irritability and eventual death. *Senecio caricida,* known by the Aztec name of *izcuinpatli* and the Spanish name *yerba del pueblo,* causes paralysis in dogs. Other species have been called *peyote*; *palo loco* ("crazy plant") or *palo bobo* ("stupefying plant"); all have neurotropic effects when ingestedt (Díaz 1976).

There are nearly 3000 species of *Senecio,* 60 of them in Mexico. Many alkaloids have been found in the genus (Raffauf 1970).

Tagetes Linnaeus

Tagetes lucida Cavanilles, Icones 3 (1795): 33; t. 264.

The Huichol Indians of northern Mexico ceremonially smoke a mixture of tobacco (*Nicotiana rustica)* and this strongly pungent species of *Tagetes* for inducing visual hallucinations (Díaz 1975, 1976). Frequently, they drink a beer prepared from

maize--*tesquino*--along with the smoking "to produce clearer visions"; the hallucinogenic *peyote* cactus (*Lophophora williamsii)* and *cai* (a cactus distillate) may likewise be ingested at the same time.

The plant was known amongst the ancient Aztecs as *yahutli*; it is currently known as *tumutsali*. It is reported that these Indians pulverized the dried plant and threw the powder into the faces of sacrificial victims "to dull their senses." The flowers were used by the Aztecs in ceremonies for the dead.

Tagetes, the genus to which the horticultural marigolds belong, has approximately 50 species native to the warmer and drier regions from Arizona to Argentina. No alkaloids are known from the genus, but its chemical composition is extremely complex with a large variety of organic constituents of different classes, including coumarine derivatives, essential oils and cyanogenic glycosides (Hegnauer 1964).

Trichocline Cassini

Trichocline exscapa Grisebach, Goelt. Abh. 19 (1874): 197.

Trichocline dealbata Bentham et Hooker fil. ex Hieronymus, Bot. Acad. Nac. Cordoba 4 (1881) 75.

Trichocline reptans (Wedd.) B. L. Robinson, Proc. Am. Acad. 49 (1913): 515.

In Argentina, the rhizome of several species of *Trichocline* is employed extensively alone or mixed with tobacco as a fumitory. Several species are known by the same names: *coro* and *contrayerba*. *Trichocline reptans* is the most commonly used in the Chacó region but *T. exscapa* and *T. dealbata* are utilized in the Andean areas of the country. The Calchaqui Indians were using *coro* as early as the 1700's but as an additive to their fermented maize beer or *chicha* (Zardini 1977).

Chemical studies of this genus have apparently not been carried out.

New World plants Alleged to Have Hallucinogenic Properties:

Amaranthaceae	*Alternanthera* sp.
	Iresine sp.
Apocynaceae	*Malouetia tamaquarina*
Araceae	*Arisaema draconium*
Convolvullaceae	*Ipomoea argyrophylla*
	Ipomoea batatas
	Ipomoea hederacea
	Ipomoea muricata
	Stictocardia tiliaefolia
Coprinaceae	*Copelandia cyanescens*
Cycadaceae	*Dioon edule*
Equisetaceae	*Equisetum arvense*
Ericaceae	*Gaultheria* sp.
Euphorbiaceae	*Sebastianea pavoniana*
Gnetaceae	*Ephedra nevadensis*
Leguminosae	*Astragallus besseyi*
	Astragallus amphioxys

	Astragallus molissimus
	Erythrina americana
	Erythrina flabelliformis
	Mimosa verrucosa
	Rhynchosia phaseoloides
Loranthaceae	*Phrygilanthus eugenioides*
Malpighiaceae	*Mascagnia psilophylla* var. *antifebrilis*
Myristicaceae	*Virola cuspidata*
Nyctaginaceae	*Mirabilis multiflora*
Papaveraceae	*Argemone mexicana*
	Eschscholzia californica
Passifloraceae	*Passiflora incarnata*
Russulaceae	*Russula* spp.
Rutaceae	*Amyris denifera*
Sapindaceae	*Paullinia yoco*
Saxifragaceae	*Hydrangea paniculata*
Solanaceae	*Capsicum frutescens* var. *grossum*
Styracaceae	*Styrax tessmannii*
Turneraceae	*Turnera diffusa*

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* Nota do autor: A few additional references are included in the expectation that readers may want more information. The citations with asterisks are those which are cited in the paper.

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CONTRIBUIÇÃO AO ESTUDO TAXONÔMICO DO GÊNERO *CRUDIA* SCHREBER (CAESALPINIACEAE) NA AMAZÔNIA BRASILEIRA[1]

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RESUMO — Foram reconhecidas para a Amazônia brasileira oito espécies para o gênero Crudia *Schreber. São apresentadas descrições, ilustrações, uma chave artificial para identificação das espécies, bem como dados de habitat, distribuíção, floração e frutificação.*

PALAVRAS–CHAVE: *Crudia*, Caesalpinaceae, Sistemática.

ABSTRACT — Eight species of the genus Crudia *Schreber are recognized from the Brazilian Amazonia. The species are described, illustrated and an artificial key for identification of the species. Data such as distribuition, habitat, flowering and fruiting fenology are also presented.*

KEY WORDS: *Crudia*, Caesalpiniaceae, Systematics.

INTRODUÇÃO

No Brasil, o gênero *Crudia* Schreber ocorre em parte do Nordeste, sendo que é na bacia amazônica que se encontra o maior número de suas espécies. O gênero tem distribuição pantropical, expandindo-se nas regiões tropicais da América Central e América do Sul, África e até a Ásia. No Neotrópico, estende-se desde a América Central até a América do Sul, ocorrendo na Colômbia, Peru, Venezuela, Guianas e Brasil, incluindo parte do Maranhão, Pará, Acre, Amapá, Amazonas, Rondônia e Roraima. Segundo Hutchinson (1967), *Crudia* possui cerca de 55 espécies distribuídas na Ásia, África e América tropicais.

O gênero *Crudia* foi descrito por Aublet (1775), que propôs três nomes diferentes: 1) *Apalatoa*, tendo como espécie-tipo, *A. spicata;* 2) *Touchiroa*, espécie-tipo *T. aromatica;* 3) *Parivoa*, com as espécies *P. grandiflora* e *P. tomentosa*, sendo que a segunda espécie foi chamada pelo autor no mesmo ano de *Touchiroa parivoa*. Logo a seguir, Aublet (1775) mudou o nome do gênero para *Vouarana*.

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Scopoli (1777) baseando-se nos caracteres morfológios do gênero como cálice fendido em 4 partes, 10 estames, fruto alado, monosperma e semente reniforme, achou que se tratava de um novo gênero e o chamou de *Waldschmidtia*, colocando em sinonímia os nomes genéricos, *Apalatoa, Touchiroa e Parivoa.*

Schreber (1789) descreveu o gênero e deu-lhe o nome de *Crudia*, que figura na lista de *Nomina conservanda* Voss *et al. 1983. Ainda no mesmo ano propôs o nome de Cyclas* para o gênero.

Necker (1790) observou os caracteres do gênero e o reconheceu como *Waldschmidtia*, tendo *Crudia* como sinônimo.

Schreber (1790), estudando as espécies de Aublet, *Eperua falcata e Eperua grandiflora*, admitiu que se tratava de duas espécies congenéricas, passou a obsevá-las, escolhendo uma especialmente, considerando ambas em um novo gênero *Dimorpha.*

Willdenow (1799) reconheceu o gênero *Crudia*, aceitou *C. spicata* como espécie-tipo do gênero, excluindo apenas o fruto por tratar-se de *Pterocarpum rohrii* Vahl.

Batsch (1802) considerou o gênero *Crudia* como pertencente a família Lomentaceae, devido ao embrião apresentar o eixo radícula curto e os estames com filetes livres.

Willdenow (1802) referindo-se às espécies de Aublet, *Eperua falcata* e *Eperua grandiflora*, deu o nome de *Panzera* à *Eperua falcata* e reteve o nome *Dimorpha*, dado por Schreber (1791) à *Eperua grandiflora*, denominando-a *Dimorpha tomentosa* (Aublet) Willdenow, baseando-se em *Parivoa tomentosa* Aublet, descrita por Aublet (1775), usualmente conhecida como *Crudia tomentosa.*

Candolle (1825) reconheceu o gênero *Crudia*, considerando *C. spicata* como espécie-tipo do gênero e transferiu o nome da espécie *Parivoa tomentosa* para *Crudia parivoa.* Assinalou a ocorrência de três espécies, *C. spicata, C. aromatica, e C. parivoa.*

Bentham (1840) estabeleceu as tribos Amherstieae, Cynometreae e Sclerolobieae, subordinando o gênero *Crudia* Schreber à tribo Cynometreae.

Bentham (1840) descreveu a espécie *Crudia bracteata* Bentham, coletada por Martin, na Guiana Francesa.

Steudel (1843) por achar que se tratava de uma Chrysobalanaceae, descreveu como *Hirtella glaberrima*, a espécie *C. glaberrima.*

Bentham (1844) foi o primeiro a descrever a espécie *Crudia oblonga*, citando como localidade típica a Guiana Francesa.

Miquel (1850) estudando os gêneros *Eperua* e *Parivoa* de Aublet, admitiu que os mesmos apresentavam características morfológicas semelhantes, por possuírem 10 estames, sendo que em *Eperua*, 9 são unidos na base e o décimo completamente livre, enquanto que em *Parivoa*, são ligeiramente mono ou diadelfos. A principal diferença é que *Eperua* apresenta filetes hirsutos e *Parivoa* são glabros. Miquel (1855) chamou o gênero *Crudia* de *Pryona.*

Grisebach (1860) transferiu a espécie *Hirtella glaberrima* Steudel para *Crudia glaberrima* Grisebach, passando a ser chamada durante muito tempo *Crudia obliqua.* Citou também a ocorrência da espécie *Crudia oblonga* em Trinidad e na Guiana.

Bentham & Hooker (1865) restabeleceram o nome *Crudia* dado por Schreber, apresentaram uma descrição sumária do gênero, colocaram-no na tribo Amherstieae,

por possuir o caráter diferencial do estípite aderido à parede do receptáculo e se referiram à ocorrência de espécies no Arquipélago Índico, na América e na África tropicais.

Bentham (1870) estudando o gênero *Crudia*, descreveu as espécies *C. amazonica* e *C. pubescens*, mencionou ainda a ocorrência da espécie *C. oblonga* Bentham e não Grisebach, originária da América Central, *C. parivoa*, espécie de Caiena, *C. bracteata* e *C. acuminata*. Ainda no mesmo ano, Bentham (1870) colocou a espécie *C. bracteata* em observação, considerando como sinônimo de *C. spicata*.

Oliver (1871) referiu-se a *Crudia* como um pequeno gênero, principalmente para a América tropical, com apenas uma espécie na África e uma ou duas nas ilhas da Índia.

Baillon (1876) considerou o gênero *Crudia* como sinônimo de *Apalatoa* Aublet.

Kuntze (1891) mudou o nome do gênero *Crudia* para *Tuchiroa*. Porém, no mesmo ano Taubert (1891) em obediência à Lei da Prioridade sugeriu que o nome *Crudia* cedesse lugar ao nome dado por Aublet, ou seja *Apalatoa*. Mais tarde, Taubert (1894) reconheceu 11 espécies do gênero, sendo 8 americanas, como: *Apalatoa glaberrima* das Ilhas Trinidad e Guiana, *A. amazonica* e outras espécies afins, da bacia amazônica.

Macbride (1919) incluiu o nome do gênero *Crudia* na lista de *Nomina conservanda*, estabilizando o problema do nome do gênero. O autor fez novas combinações mudando o nome das espécies, *C. obliqua* para *C. glaberrima* (Steudel) Macbride e *C. parivoa* passou a ser *C. tomentosa* (Aublet) Macbride.

Wildeman (1920) considerou o gênero como polimórfico, por ocorrer na África um número relativamente grande de espécies, diferindo entre si, principalmente quanto ao número e forma dos folíolos, dimensão das estípulas e comprimento dos pedicelos das flores.

Ducke (1922) citou a ocorrência do gênero *Crudia* na Amazônia, reconheceu 15 espécies, distribuídas na América equatorial, África ocidental e Índia. Descreveu a espécie *C. aequalis*, coletada por ele no Pará, em 1916.

Lemée (1930) considerou o gênero *Crudia* como pertencente à família Leguminosae, subfamília Caesalpinioideae, tribo Amherstieae, com cerca de 35 espécies nas regiões tropicais. Registrou como sinônimos os nomes *Apalatoa* Aublet, *Cyclas* Schreber, *Pryona* Miquel, *Touchiroa* Aublet e *Waldschmidtia* Scopoli.

Amshoff (1939) estudando o gênero *Crudia* na América do Sul, enfatizou que as espécies eram bastante discutidas em termos nomenclaturais e fitogeográficos. Reconheceu 8 espécies, apresentando uma chave para a separação das mesmas. Concordou com Bentham, que afirmava que a maioria das espécies de *Crudia* habita a região amazônica e que o nome *Crudia* deve ser considerado em lugar de *Apalatoa*. Pulle (1939) fez uma descrição do gênero, referindo-se a sua distribuição e aos nomes populares.

Fasbender (1959) concordou com Bentham & Hooker (1865) e considerou que a morfologia do pólen devia ser usada juntamente com o caráter da fusão do estípite aderido à parede do receptáculo, para resolver a questão da posição sistemática do complexo Amherstieae-Cynometreae.

Cowan (1981), baseando-se em caracteres palinológicos, da anatomia da madeira, da composição química, morfologia da folha, processados por computador, colocou

Crudia na tribo Detarieae (Cynometreae).

Watson & Dallwitz (1983) realizaram estudos sobre o gênero *Crudia*, incluindo anatomia, morfologia, classificação e chave para a separação das espécies, concordou com Cowan (1981), colocando o gênero *Crudia* na tribo Detarieae, admitindo tratar-se de um gênero tropical com 55 espécies.

O gênero *Crudia*, anteriormente pertencia à família Leguminosae, subfamília Caesalpinioideae, atualmente considerada como família propriamente dita, segundo Cronquist (1981), passando o gênero a pertencer à família Caesalpiniaceae. Analisando as diversas opiniões sobre a posição tribal do gênero *Crudia*, decidiu-se concordar com Bentham & Hooker (1865) e acatar as considerações de Fasbender (1959), subordinando-o à tribo Amherstieae.

O objetivo principal deste trabalho foi o estudo taxonômico de 8 espécies do gênero *Crudia* reconhecidas até agora na Amazônia brasileira e representa uma contribuição para a taxonomia e conhecimento das espécies que ocorrem nesta região, como suporte a inventários florísticos e pesquisas etnobotânicas.

MATERIAL E MÉTODOS

Foram realizadas excursões para coletar material botânico por várias regiões da Amazônia brasileira, com o objetivo de levantar os taxa em estudo, conhecer o seu habitat e sua distribuição. O material coletado foi herborizado e incorporado ao Herbário do INPA.

Com o fim de verificar a variação morfológica, distribuição, dados ecológicos e comparar o material determinado por diversos especialistas, foi consultado o material dos seguintes herbários: IAN, INPA, MG, MO, NY, R, RB, UB, US.

A descrição do gênero é baseada em Hutchinson (1967) e Watson & Dallwitz (1983).

A identificação das espécies foi realizada por morfologia comparada, utilizando-se bibliografia especializada, principalmente os trabalhos de Bentham (1870), Amshoff (1939) e Macbride (1943), comparando-se as descrições originais com o material herborizado.

Para a descrição da folha, seguimos a terminologia adotada por Font Quer (1953), Lawrence (1955), Rizzini (1964) e Radford *et al.* (1974). A classificação e terminologia usadas para o tipo de pêlo foi a de Lawrence (1951) e Payne (1978).

A delimitação geográfica da Amazônia brasileira foi baseada em Prance (1977) e a terminologia usada para os tipos florestais da região foi a de Prance (1979).

IMPORTÂNCIA ECONÔMICA

Poucas referências sobre a importância econômica das espécies do gênero *Crudia* foram encontradas na literatura. Record & Hess (1943) mencionam que as espécies de *Crudia* possuem madeira dura, resistente e forte, textura e brilho médios, mas sem nenhum valor comercial. Ducke (1949) salienta a importância de *C. glaberrima*, cuja madeira pode ser usada em marcenaria. Correa (1984) refere-se a espécie *C. tomentosa*, como fornecedora de madeira de cerne rijo e escuro, de densidade própria para marcenaria e sua casca é utilizada como medicinal.

Braz Filho *et al.*, (1973) utilizaram a madeira do tronco de *C. amazonica* em extrato alcoólico e em cromatografia de sílica, obtiveram uma fração cristalina principal e que, purificada por sublimação, deu um flavonóide, denominado apigenina (5, 7, 4 — trihidroxiflavona).

TRATAMENTO SISTEMÁTICO

Crudia Schreber, Gen. Plant. 1:282. 1789, *nom. cons.*
Apalatoa Aublet, Hist. Pl. Guian. Fr. 1:382-383. t. 147. 1775.
Touchiroa Aublet, Hist. Pl. Guian. Fr. 1:384-385. t. 148. 1775.
Parivoa Aublet, Hist. Pl. Guian. Fr. 2:757. t. 303. 1775.
Vouarana Aublet, Suppl. 12. t. 347. 1775.
Waldschimidtia Scopoli, Introd. 100. 17777.
Cyclas Schreber, Gen. Plant. 1:282. 1789.
Dimorpha Willdenow, Spec. Plant. 3(2):971. 1799.
Pryona Miquel, Fl. Ind. Bat. 1:1081. 1855.
Tuchiroa O. Kuntze, Rev. Gen. Plant. 1:211. 1891.

Árvores ou arbustos; troncos cilíndricos, estriados, ramos pubescentes ou glabros; folhas compostas, alternas, imparipinadas; estípulas caducas ou persistentes, estreitas ou largas, foliáceas ou membranáceas, côncavas, elípticas, lanceoladas, pubescentes ou glabras; pecíolos e peciólulos de tamanho variável, cilíndricos, estriados, glabros ou pubescentes; folíolos muitos ou poucos por folha, de forma e tamanho variáveis, margem inteira, subcoriáceos ou membranáceos, glabros ou pubescentes; ápices variáveis, acuminados, acuminado-caudados, cuspidados, obtusos, obtuso-caudados e às vezes retusos, com bases obtusas, oblíquas e obtuso-arredondadas; nervação do tipo broquidódromo; nervuras impressas ou levemente promínulas, superfície inferior com nervuras primária e secundárias proeminentes; nervuras secundárias nunca opostas, arranjadas irregularmente, 6—14 pares arqueado-ascendentes, anastomosando-se, sempre afastadas da margem. Inflorescências em geral racemosas, simples, terminais ou axilares; brácteas e bractéolas ausentes, quando persistentes, ovais ou obtusas, pubescentes ou glabras; brácteas membranáceas e venadas; pedúnculos e pedicelos, cilíndricos, pubescentes ou glabros; flores hermafroditas, pétalas ausentes; cálice com 4 sépalas reflexas na antese, em geral soldadas na base; prefloração imbricada; estames 10, livres; anteras ovais ou oblongas, deiscência rimosa, dorsifixas; ovário subséssil ou estipitado, hirsuto, 1—6 locular; estilete terminal, filiforme, conduplicado; estigma globoso; óvulos anátropos; frutos vagens, ovais ou largamente oblongas, clavadas, falcadas e recurvadas com suturas convexas, comprimidas, coriáceas ou lenhosas com nervuras promínulas, 1—2 valvar, margem espessa; semente 1—6, ovais ou reniformes, planas ou convexas, emarginadas, sem endosperma e sem arilo.
ESPÉCIE—TIPO: *Crudia spicata* (Aublet) Willdenow

Chave para as espécies de *Crudia* Schreber da Amazônia brasileira.

1. Folíolos inteiramente glabros ou pubescentes na face inferior.
   2. Folíolos longo-acuminados com 6—16 cm de comprimento (média, 8.5 cm), ápice com 5—15 mm de comprimento; base arredondada ou obtusa.

3. Bractéolas próximas ao cálice de 1—2 mm de comprimento; folíolos simétricos, oval—lanceolados a oval—acuminados; ovário densamente pubescente.. *1. C. aequalis.*
3. Bractéolas próximas ao cálice de 9—18 mm de comprimento; folíolos assimétricos, oblongos; ovário pubescente apenas na sutura. .... *2. C. bracteata*
2. Folíolos curto-acuminados ou curto-cuspidados com 5—12 cm de comprimento; base levemente oblíqua.
4. Folíolos 3—7 por folha; flores com 4—5 mm de comprimento, ovário 1 — ovulado.. 3. C. tomentosa
4. Folíolos 9—13 por folha; flores 5—15 mm de comprimento; ovário 2—6— ovulado.
5. Pedicelos, 2—5 mm de comprimento; sépalas glabras internamente e pubescente na face externa; bractéolas pedicelares de 1—2 mm de comprimento........................ 4. C. glaberrima.
5. Pedicelos, 10—15 mm de comprimento; sépalas subglabras externamente e rufo-seríceas na face interna; bractéolas pedicelares de 8—12 mm de comprimento.................... 5. C. amazonica

1. Folíolos inteiramente pubescentes.
6. Ápice dos folíolos agudo e caudado-acuminado, às vezes retuso.
7. Folíolos com 6—11 cm de comprimento, ovados a oblongo-lanceolados; estípulas oblíquo ovais, cerca de 10—20 mm de comprimento; bractéolas pedicelares de 8—15 mm de comprimento. .... *6. C. spicata*
7. Folíolos com 3—10 cm de comprimento, elípticos a obovados; estípulas elípticas, cerca de 6—10 mm de comprimento. .... *7. C. pubescens*
6. Ápice de folíolos obtuso a obtuso-acuminado, às vezes arredondado..8. C. oblonga

1. *Crudia aequalis* Ducke Arch. Jard. Bot. Rio de Janeiro 3(3):91. 1922; Macbride, Publ. Field. Mus. Nat. Hist. 13(3): 122—123. 1943; Amshoff, Bol. Técn. Inst. Agron. Norte. 28:82. 1953. Fig. 1.
Tipo: *A. Ducke s.n.* Brasil. Pará, rio Tapajós, cachoeira do Mangabal, mata de beira de rio, setembro de 1916, fl. (holótipo MG 16431; isótipo RB; foto do tipo MG, MO, RB).

Árvore de até 18 m de altura. Copa amplamente ramificada, córtex dos ramos cinza-escuro e marrom-escuro. Ramos cilíndricos, estriados glabros. Folhas alternas, pecioladas, 4—6 folioladas; estípulas conadas, glabras, 1—2 mm de comprimento; peciólulos cilíndricos, glabros, 6—15 mm de comprimento; peciólulos glabros, 3—5 mm de comprimento; folíolos membranáceos, elípticos, oval-lanceolados a oval-oblongos, simétricos, glabros, 6—16 cm por 4—6.5 cm de largura, ápice acuminado,
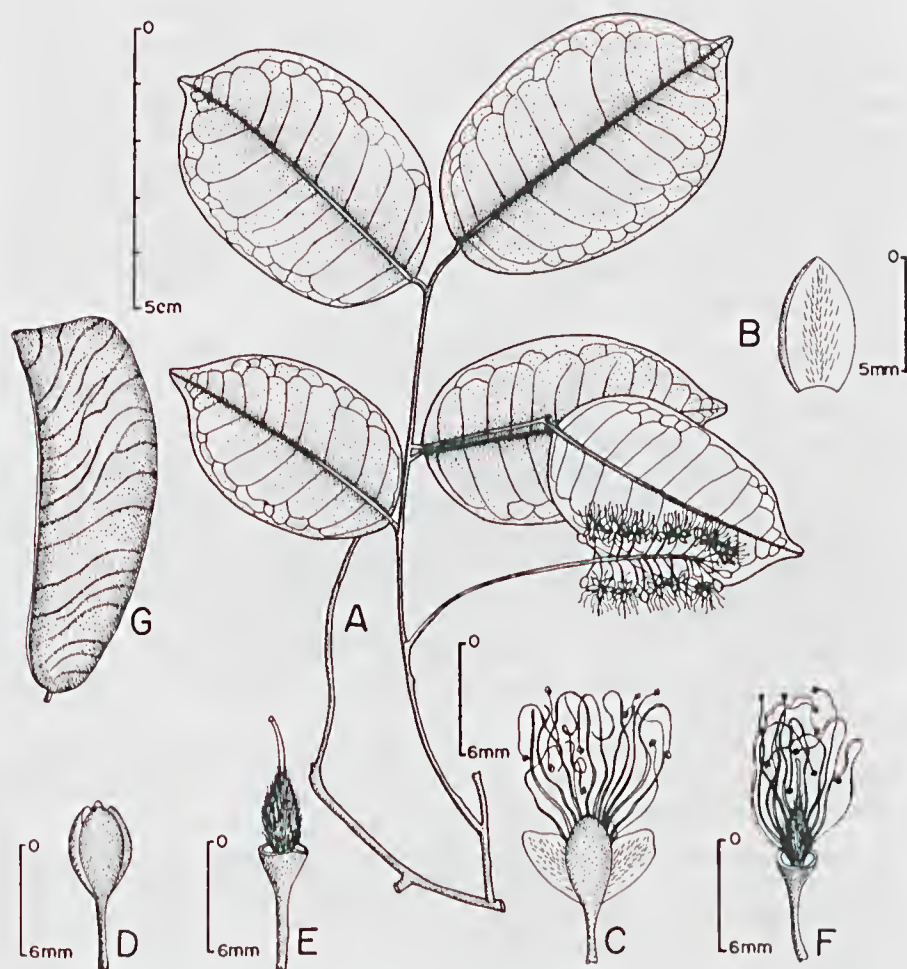
Figura 1 — *Crudia aequalis* Ducke (A-F, *Ducke s.n.*, RB 54284, G. *Ducke s.n.*, RB 35196): A, ramo com inflorescência; B, sépala; C, flor; D, botão floral; E, gineceu e ápice do hipântio e androceu; G, fruto imaturo.

5—15 mm de comprimento, base arredondada, margem inteira, nervuras primária e secundárias levemente impressas na face superior; nervuras secundárias 10—11 pares, arqueado-ascendentes. Inflorescência racemosa, axilar ou terminal, 8—15 cm de comprimento; pedúnculo e pedicelos glabros, 10—15 mm de comprimento; bractéolas pedicelares e próximas ao cálice, lineares, glabras, 1—2 mm de comprimento, decíduas; flores brancas e esverdeadas; cálice, 4 sépalas membranáceas, ovais, glabras externamente, pubescentes internamente, 7—9 mm de comprimento por 3.5—6.5 mm de largura, ápice agudo, base arredondada; hipântio caliciforme, 1—1.3 mm de comprimento; androceu, 10 estames, exsertos, 14.5—16 mm de comprimento; filetes glabros, 12—13 mm de comprimento; anteras ovais, 2—3 mm de comprimento, deiscência rimosa, dorsifixas; gineceu, 12 mm de comprimento; ovário ovóide, subséssil, 8 mm de comprimento por 3 mm de diâmetro, 2—4 — ovulado densamente pubescente; estilete glabro, 4 mm de comprimento; estigma ligeiramente dilatado. Fruto, vagem falcada, 3.5—9 cm de comprimento, achatada lateralmente ou inflada, coriácea, levemente cinéreo-seríceo-tomentosa, deiscente na maturação.

Distribuição geográfica: Brasil: Amazonas, Pará e Amapá, Figura 4. *Fenologia*: Floresce nos meses de junho, julho, agosto e setembro; frutifica nos meses de novembro e dezembro.
Habitat: Mata de terra firme e mata de várzea estacional.
Espécimes examinados: BRASIL. *Amapá*. rio Araguari, entre os campos 4 e 5, 1°47'N — 51°58'W e 26'N — 51°58'W, 07.09.1961, *Pires et al., 50754*, MG. *Amazonas*. Manaus, caminho do Joaquim Paula, 29.08.1935, *Ducke s.n.*, (RB 35196); Itapiranga, rio Uatumã, margem esquerda, em frente à boca do rio Pitinga, 24.08.1979, *Cid et al., 725* (INPA, MG). *Pará*. Santarém, rio Tapajós, Morro do Mangabal, chapada do morro do Botica, 18.08.1923, *Ducke s..*, (RG 16905); rio Jari, entre Monte Dourado e Munguba, 07.07.1986, *Oliveira 4773*, (NY).

Crudia aequalis Ducke ocorre na Amazônia brasileira e segundo Ducke (1949) ocorre também na Colômbia.

A espécie se caracteriza segundo Amshoff (1953) pelos folíolos simétricos, diferindo assim das outras espécies que apresentam folíolos assimétricos e também pelos pedicelos longos e frutos não rugosos.

2. *Crudia bracteata* Bentham in Hooker, Journ. Bot. 2:101.1840; Bentham in Martius, Fl. Bras. 15 (2).238.1870; Amshoff, Meded. Mus. Bot. & Herb. Rijks Univ. Utrecht 52:12, fig. lb. 1939; Macbride, Publ. Field. Mus. Nat. Hist. 13 (3)1:122—123. 1943. Figura 2.

Tipo: *K. Martius s.n.* Guiana Francesa, s.d., fl. (holótipo K *n.v.; isótipo P n.v.;* parátipo P n.v).

Crudia spicata sensu Bentham in Martius, Fl. Bras. 15(2): 238. 1870; non Willdenow.

Árvore de até 35 m de altura. Copa ampla, córtex marrom-acinzentado ou marrom-escuro, glabro. Ramos cilíndricos, estriados, glabros. Folhas alternas, pecioladas, 5—7 folioladas; estípulas subuladas, geralmente glabras, 1—2 mm de
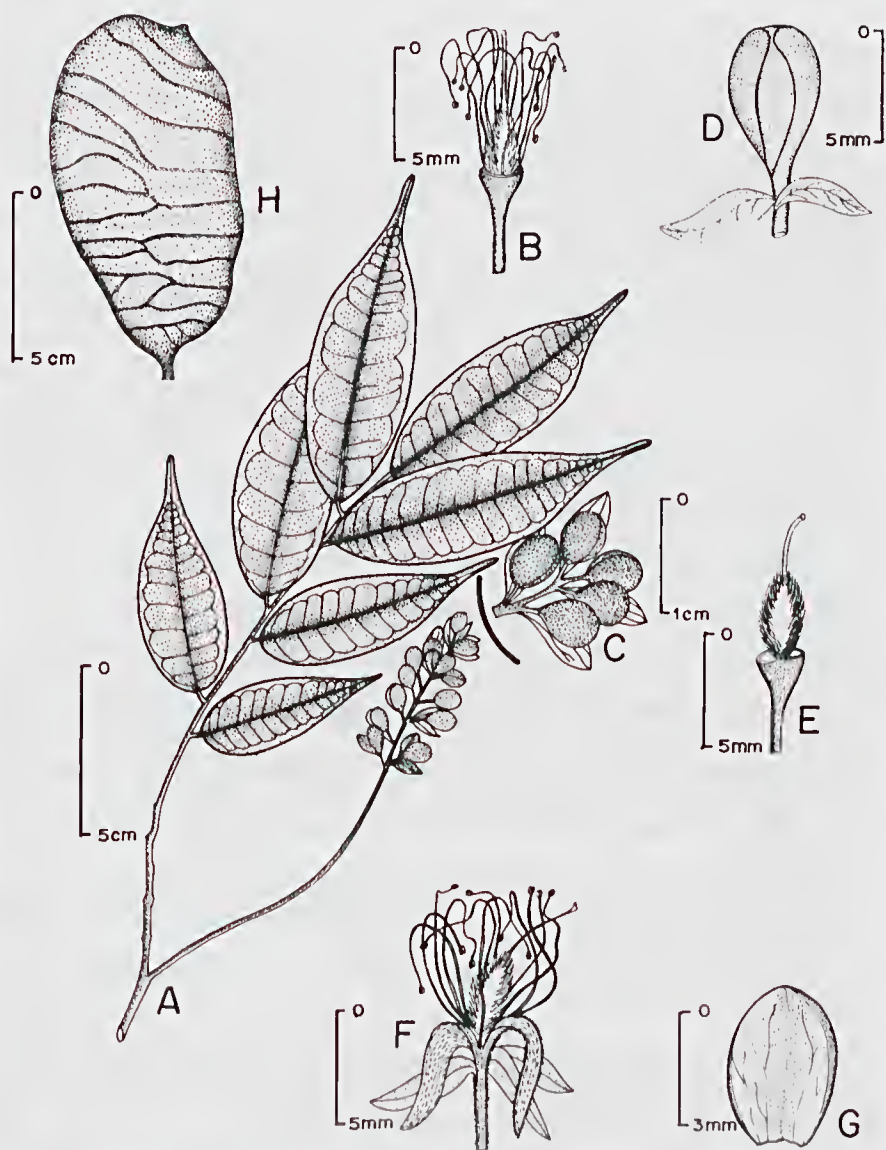
Figura 2 — *Crudia bracteata* Bentham (A-G, *Ducke 586; H. Ducke 1604*): A, ramo com inflorescência em detalhe, B, gineceu e androceu; C, ápice da inflorescência em detalhe; D, botão floral e bractéolas; E, hipântio; F, flor; G, sépala; H, fruto imaturo.

comprimento por 1 mm de largura; pecíolos cilíndricos, glabros, 5—14 mm de comprimento; pecíolulos glabros, 2—3 mm de comprimento; folíolos membranáceos, elípticos ou oval-oblongos, glabros, 5—7 cm comprimento por 2—3.5 cm de largura, ápice acuminado ou acuminado-caudado, 5—12 mm de comprimento, base arredondada ou obtusa, margem inteira; nervuras primárias e secundárias impressas fracamente na face superior; nervuras secundárias 7—12 pares, arqueado-ascendentes. Inflorescência racemosa, axilar ou terminal, 7—12 cm de comprimento; pedúnculo e pedicelos glabros; pedicelos, 2—3 mm de comprimento; bractéolas pedicelares membranáceas, glabras, 9—18 mm de comprimento por 4—6 mm de largura, ápice agudo e base obtusa; bractéolas próximas ao cálice membranáceas, glabras, 4—5 mm de comprimento por 3—4 mm de largura, ápice agudo e base obtusa; flores brancas a esverdeadas; cálice, 4 sépalas, membranáceas, ovais, glabras, 9—15 mm de comprimento, 6—9 mm de largura, ápice agudo ou obtuso, base arredondada ou obtusa; hipântio caliciforme, 1—1.3 mm de comprimento; androceu, 10 estames, 9—12 mm de comprimento; filetes glabros, 5—9 mm de comprimento; anteras elíptico-lanceoladas, 2—3 mm de comprimento, deiscência rimosa, dorsifixas; gineceu, 11—12 mm de comprimento; ovário ovóide, subséssil, 8—12 mm de comprimento, 2—3 mm de diâmetro, 2—4 ovulado, pubescente somente na sutura; estilete glabro, 10 mm de comprimento; estigma ligeiramente dilatado. Fruto, vagem oblonga, coriácea, glabra, venada, até 13 cm de comprimento por 7 cm de largura; semente única, subreniforme ou oblonga, comprimida.

Distribuição geográfica: Brasil: Amapá, Amazonas, Pará. Figura 4.

Fenologia: Floresce de janeiro a outubro; frutifica de março a dezembro.

Habitat: Mata de terra firme baixa, mata de várzea estacional e margens de rios.

Espécimes examinados: BRASIL. Amapá. Margem direita do rio Flechal, 14°5'N 50°58'W, 13.08.1962 *Pires et al., 52515, (MG, US). Amazonas.* São Paulo de Olivença, próximo de Palmares, 11.09 — 10.1936, *Krukoff* 8570 (US). *Pará.* Belém, Horto Botânico, 05.01.1907, *Huber s.n.*, (MG 9398); rio Mapuera, Taboleirinho, 12.12.1907, *Ducke s.n., (MG 9132); Breves, rio Aramá, 12.11.1922, Ducke s.n., (RB 16904).*

Crudia bracteata Bentham difere de *Crudia spicata* (Aublet) Willdenow, pelos folíolos glabros, estípulas pequenas, subuladas, glabras, inflorescência glabra, ovário tomentoso apenas na sutura lateral e fruto glabro.

A espécie é conhecida como "Ipê", "Ipê-rana" e "Rim-de-paca", no Pará (Belém).

3. Crudia tomentosa (Aublet) Macbride, Contr. Gray. Herb. 59:20. 1919; Amshoff, Meded. Bot. Mus. & Herb. Rijks. Univ. Utrecht. 52: 13. 1939; Macbride, Publ. Field. Mus. Hist. 13(3):122—123. 1943. Figura 3.

Tipo: *J. Aublet s.n.* Guiana Francesa, s.d., fr. (holótipo BM n.v.; foto do tipo NY).

Parivoa tomentosa Aublet, Hist. Pl. Guian. Fr. 2:759 t.304. 1775.
Touchiroa parivoa Richard in de Candolle, Syst. Nat. Reg. Veg. 2:5—20. 1825.

Apalatoa tomentosa (Aublet) Taubert, Centralbl. 47:394. 1891.
Crudia parivoa DC in Ducke, Arch. Jard. Bot. Rio de Janeiro 3(3):90—91. 1922.

Árvore de até 30 m de altura. Copa ampla, córtex marrom-acinzentado ou marrom-ferrugíneo. Ramos cilíndricos, estriados, glabros. Folhas alternas, pecioladas, 3—5 folioladas; estípulas estreitas, foliáceas, decíduas ou raramente persistentes, geralmente glabras, 7—10 mm de comprimento, 1—3 mm de largura; pecíolos cilíndricos, glabros, 8—15 mm de comprimento; peciólulos glabros, 2—3 mm de comprimento; folíolos membranáceos, elípticos ou ovado-oblongos, glabros, 5—12 cm de comprimento por 2.5—5 de largura, ápice acuminado, 3—5 mm de comprimento por 2.5—5 mm de largura, base aguda, margem inteira, nervuras primária e secundárias impressas na face superior, proeminentes na inferior; nervuras secundárias, 6—14 pares, arqueado-ascendentes. Inflorescência racemosa, axilar ou terminal, 4—7 cm de comprimento; pedúnculo glabro; pedicelos glabros, 3—4 mm de comprimento; bractéolas pedicelares e próximas ao cálice, lanceoladas, membranáceas, glabras, 1—2 mm de comprimento, 0.5—1 mm de largura, ápice agudo, base aguda e obtusa; flores brancas a esverdeadas; cálice, 4 sépalas, membranáceas, ovais, glabras, 4—5 mm de comprimento, 3 mm de largura, ápice agudo, base obtusa; hipântio caliciforme, pubescente, 1—1.2 mm de comprimento; androceu, 10 estames, exsertos, 8—10 mm de comprimento; filetes glabros, 10 mm de comprimento; anteras elíptico-lanceoladas, 2—3 mm de comprimento, deiscência rimosa, dorsifixa; gineceu, 8 mm de comprimento; ovário ovóide, subséssil, 4—6 mm de comprimento, 2—3 mm de diâmetro, 1-ovulado, tomentoso; estilete glabro, 4 mm de comprimento, estigma ligeiramente dilatado. Fruto, vagem oval ou recurvada com sutura convexa, coriácea, unilocular, bivalvar, superfície tomentosa, ferrugínea, mais ou menos rugosa e sem nervações, mais espessa que outras espécies; semente única, reniforme, espessa, 3 cm de comprimento, 2.5 cm de largura.

Distribuição geográfica: BRASIL: Pará, Rondônia e Maranhão. Figura 4.

Fenologia: Floresce de janeiro a novembro; frutifica de janeiro a dezembro.

Habitat: Campo, terrenos alagados, não inudáveis, mata de terra firme, mata de várzea estacional e mata pantanosa.

Espécimes examinados: BRASIL. Pará. Marajó, Fazenda Alegre, 26.08.1896, *Huber 195*, (MG); Soure, Ilha de Marajó. Praia de Mata Fome e Santa Marta, 18.11.1948, *Black 3626*, (IAN, NY, US); Salvaterra, Joanes, Marajó, 10.11.1982, *Rosário et al.*, 115 (INPA); Monte Alegre, margem inundada do Gurupatuba, 08.03.1923, *Ducke s.n.*, (RB 16900); Mosqueiro, praia do Ariramba, 30.09.1923, *Ducke s.n., (RB 16901); Vizeu, praia do Sernambi, 23.12.1958, N.T. Silva 544* (IAN); Conceição, perto da foz do rio Juruena, 13.01. 1952, *Pires 3906*, (INPA); Portel, rio Xingu, 17.11. 1955, *Black 32526*, (MG); Porto de Moz, rio Xingu em frente a Souzel, 17.11. 1956, *Fróes 32326*, (IAN, NY, US); rio Gurupi, 1.03.1958, *Fróes 34099*, (IAN, US). *Rondônia*. Estrada Porto Velho — Cuiabá, entre Nova Vida e

Figura 3 — *Crudia tomentosa* (Aublet) Macbride (A—G, *Ducke 606*): A, ramo com inflorescência; B, gineceu e ápice do hipântio; C, fruto maduro; D, botão floral; E, androceu e gineceu; F, flor; G, sépala.

Figura 4 — Distribuição geográfica de: O *Crudia aequalis* Ducke; • *Crudia bracteata* Bentham; ▲ Crudia tomentosa (Aublet) Macbride na Amazônia brasileira.

Vila Rondônia, 24.09.1963, *Maguire et al., 56758,* (NY, RB, US). *Maranhão.* Rio Maracassumé, mata da cachoeira 15.10.1932, *Fróes 1943,* (NY,US); Vitória do Mearim, Estrada do rio Mearim-Lapela, campo coberto, sujeito a inundações periódicas, 15.01.1976, *N.T. Silva 4189,* (IAN); Santa Inêz, margem direita do rio Pindaré próximo a rodovia de São Luiz de Gonzaga a Santo Antônio, 35 a 53 km de Bacabal, 4°19'W, Fazenda São Francisco, 11 Km ao Norte do Km 337 da BR—316, 4°0'S, 44°56'W, 25.09.1980, *Daly 251* (INPA).

Crudia tomentosa (Steudl) Macbride, segundo Ducke (1915), é conhecida na Guiana Francesa, porém não é encontrada em toda a Amazônia, ocorrendo na região dos campos, ao nordeste da ilha de Marajó, nos terrenos elevados, não inundáveis. Segundo Martyn (1937), a espécie foi coletada também na Guiana.

A espécie distingue-se das outras espécies por possuir flores menores que as outras espécies e pelo fruto, que é uma vagem oval ou às vezes recurvada com sutura convexa, bastante espessa com semente única.

No Pará, a espécie é conhecida como "Jutahy-rana" (Marajó e Mosqueiro).

4. Crudia glaberrima (Steudel) Macbride, Contr. Gray. Herb. 59:20. 1919; Amshoff, Meded. Bot. Mus. & Herb. Rijks Univ. Utrecht, 52.13. 1939. Figura 5.
Tipo: *Hostmann & Kappler 712.* Trinidad, s.d., fl. (holótipo *n.v.).*
Hirtella glaberrima Steudl. Fl. Rat. 26(45):761.1843; Amshoff, Bol. Técn. Inst. Agron. Norte. 28.08.1953.
Crudia obliqua Grisebach, Fl. Brit. W. Ind. Isl. 216.1860; Amshoff, Meded. Bot. Mus. & Herb. Rijks Univ. Utrecht 52:13. 1939.
Crudia hirtelloides Miquel in Martius, Fl. Bras. 15(2): 238.1870.
Apalatoa glaberrima (Steudel) Taubert, Bot. Centralbl. 47:394. 1891.

Árvore de até 20 m de altura. Copa ampla, córtex cinza-escuro a marrom-escuro, glabro. Ramos cilíndricos, glabros. Folhas alternas, pecioladas, 4—7 folioladas; estípulas foliáceas, elípticas, lanceoladas, glabras, 5—10 mm de comprimento, 1—2 mm de largura; pecíolos cilíndricos, glabros, 8—12 mm de comprimento; peciólulos glabros, 0.5—0.7 mm de comprimento; folíolos membranáceos, ovais ou ovado-oblongo, glabros ou raramente pubescentes, 4—16 cm de comprimento por 2.5—8 cm de largura, ápice acuminado, 0.5—1.8 mm de comprimento, base arredondada a ligeiramente oblíqua, margem inteira, nervuras primária e secundárias impressas na face superior, proeminentes na inferior; nervuras secundárias 7—14 pares, arqueado-ascendentes. Inflorescência racemosa, axilar ou terminal, 10—22 cm de comprimento; pedúnculo e pedicelos pubescentes; pedicelos, 2—5 mm de comprimento; bractéolas próximas ao cálice pubescentes, diminutas e decíduas; flores brancas a esverdeadas; cálice, 4 sépalas membranáceas, ovais, glabras internamente, pubescentes externamente, 13—14 cm de comprimento por 3—4 mm de largura, ápice agudo, base arredondada e obtusa; hipântio caliciforme pubescente, 1—1.4 mm de comprimento; androceu, 10 estames, excertos, 13 mm de comprimento; filetes glabros, 10 mm de comprimento; anteras elíptico-lanceoladas, 3 mm de comprimento, deiscência longitudnal, rimosa, dorsifixa; gineceu, 14—17 mm de comprimento; ovário ovóide, subséssil, 2—4 — ovulado, densamente viloso; estilete glabro, 10—15 mm de comprimento; estigma pouco dilatado. Fruto, vagem oblíqua às vezes clavada,
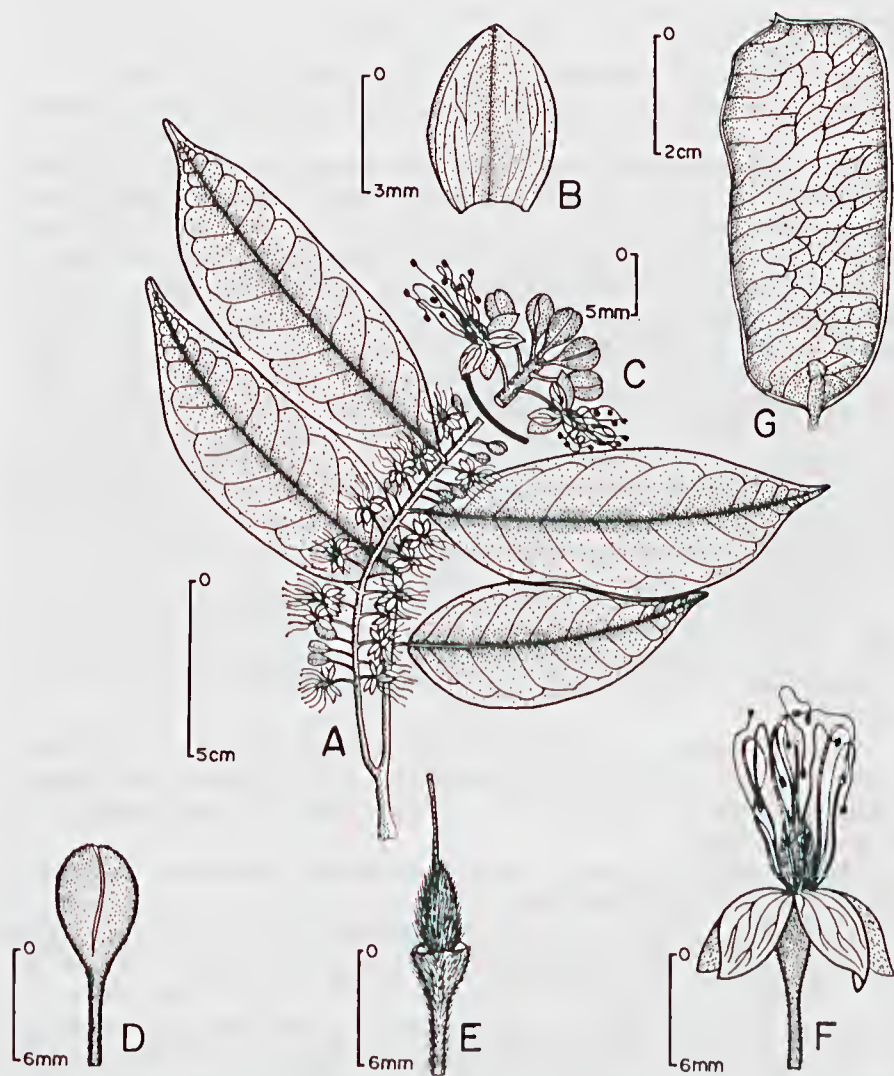
Figura 5 — *Crudia glaberrima* (Steudel) Macbride (A-F, *Prance et al.* 16784: G, *J. Revilla et al.*4487): A, ramo com inflorescência; B, sépala; C, ápice da inflorescência em detalhe; D, botão floral; E, hipântio; F, flor; G, fruto imaturo.

coriácea, comprimida, 7—26 mm de comprimento por 6.5—9.5 cm de largura, superfície marrom, rugosa, com nervações ferrugíneo-tomentosas anastomosadas; sementes, 1—3, reniformes, 4—7.5 cm de comprimento por 3.5—5 de largura.

Distribuição geográfica: Brasil: Acre, Amapá, Amazonas, Pará. Figura 8.

Fenologia: Floresce de janeiro a agosto; frutifica de março a dezembro.
Habitat: Mata de terra firme, mata de várzea estacional e mata de igapó estacional.

Espécimes examinados: BRASIL. *Acre.* Itu, rio Acre, 09.11.1923, *Kuhlmann 798,* (RG). *Amapá.* Macapá, Km 38 para Mapati, 02.02.1955, *Pires et al., 4754,* (IAN); rio Araguari, beira do lago, 22.07.1951, *Fróes et al., 27616,* (IAN); rio Apurema, igapó, 23.07.1951, *Fróes et al., 27619,* (NY, R). *Amazonas.* Margem esquerda do rio Negro em frente a São Felipe, 24.09.1952, *Fróes 28740,* (IAN); Humaitá, margem leste do rio Madeira, 3 Km ao norte de Humaitá, 03.12.66, *Prance et al., 3599* (INPA, NY, US); Ilha Aramaçá, quase oposto à Tabatinga, 24.07.1973, *Prance et al., 16784,* (MO, NY, US). *Pará.* Belém, igarapé entre S. João e Val de Cães, 27.05.1926, *Ducke s.n.,* (RG 20251); Ilha do Mosqueiro, próximo de Belém, 3—9.11.1929, *Killip et al., 30468,* (US); Vigia, margem inundada do rio, 28.06.1927, *Ducke s.n.,* (US 1040824); Ilha de Marajó, Ponta de Pedras, rio Marietê, lugarejo Paraíso, 19.03.1977, *Oliveira 6582,* (MG); Almeirim, margem (várzea) do paraná, 23.08.1918, *Ducke s.n.,* (MG 17232); Monte Dourado, margem do rio Jari, 09.08.1969, *N.T. Silva 2363,* (IAN).

Crudia glaberrima (Steudel) Macbride, segundo Bentham (1870) ocorre em Caiena, Suriname e Guiana. Ducke (1915, 1925 e 1949) cita a ocorrência da espécie no Pará: Belém , margem do Guajará, Vigia, Cametá, margem do Tocantins, Gurupá e Almeirim, bacias de riachos afluentes do Amazonas. Também ocorre na Guiana e Trinidad.

A espécie caracteriza-se por apresentar folíolos longos raramente pubescentes, bractéolas pedicelares, diminutas e pubescentes, sépalas glabras internamente e pubescentes na face externa e o fruto é uma vagem oblíqua às vezes clavada, maior que das outras espécies.

No Acre, a espécie é conhecida como "Iangelim", no Amazonas, "Orelha-de-cachorro", e no Pará, "Pracuubarana".

5. *Crudia amazonica* Spruce ex Bentham in Martius, Fl. Bras. 15(2): 328. 1870; Amshoff, Bol. Técn. Inst. Agron. Norte. 28.83.1953. Figura 6.

Tipo: *R. Spruce 858.* BRASIL. Pará, Santarém, rio Amazonas, maio 1850, fl. (lectótipo K *n.v.*, isolectótipo K *n.v.;* foto do tipo NY, RB). *R. Spruce 1520.* BRASIL. Amazonas, parte meridional do rio Negro na confluência com o rio Solimões, maio 1851, fl. (parátipos K *n.v.;* RB).

Apalatoa amazonica Taubert in Centralbl. 47: 394.1891; Amshoff, Bol. Técn. Inst. Agron. Norte. 28:83.1953.

Árvore 25—30 m de altura. Copa ampla,muito esgalhada e pouco densa, córtex

dos ramos cinza-escuro ou marrom. Ramos cilíndricos, estriados, glabros. Folhas alternas, pecioladas, 9—13 folioladas; estípulas lanceoladas, membranáceas, glabras, 5—8 mm de comprimento; pecíolos cilíndricos, glabros, 4—11 mm de comprimento; peciólulos glabros, 3—4 mm de comprimento; folíolos membranáceos, elípticos ou oblongo-lanceolados, glabros ou infrapubescentes, 7—14 cm de comprimento por 1.5—3 mm de largura, ápice acuminado, base aguda, arredondada, margem inteira; nervuras primária e secundárias impressas, levemente glabras na face superior, às vezes pubescentes na infeior; nervuras secundárias 10—11 pares, arqueado-ascendentes. Inflorescência racemosa, axilar ou terminal, 13—15 cm de comprimento; pedúnculo e pedicelos glabros; pedicelos, 10—15 mm de comprimento; bractéolas pedicelares membranáceas, pubescentes, 8—12 mm de comprimento por 3—4 mm de largura; bractéolas próximas ao cálice, membranáceas, 4—5 de comprimento por 4 mm de largura; ápice agudo, base obtusa; flores esverdeadas, fragrantes, pedicelares; cálice, 4 sépalas membranáceas, obtusas, externamente glabras e internamente rufo-seríceas, 5—15 mm de comprimento por 5—7 mm de largura, ápice agudo ou acuminado e base arredondada ou obtusa; hipântio caliciforme, 1—1.5 mm de comprimento; androceu, 10 estames, exsertos, 13 mm de comprimento; filetes glabros, 10 mm de comprimento; anteras ovais, 2—3 mm de comprimento, deiscência rimosa, dorsifixas; gineceu, 10—15 mm de comprimento; ovário ovóide, subséssil, rufo-viloso, 5—6 ovulado, densamente pubescente; estilete glabro, 8—10 mm de comprimento; estigma ligeiramente dilatado. Fruto, vagem, oval, achatada lateralmente ou inflada, 10—17 cm de comprimento, deiscente na maturação, coriácea, rufo-velutina, rugoso-venada; semente, 1—2, reniformes, 3—4 cm de comprimento, côncavas, com cavidade interna, com possibilidade de flutuação, promovendo a dispersão.

Distribuição geográfica: Brasil: Amazonas, Pará e Rondônia. Figura 8.

Fenologia: Floresce e frutifica durante todo o ano.

Habitat: Mata de terra firme, capoeira, mata de várzea estacional, mata de igapó estacional e mata de várzea do estuário.

Espécimes examinados: BRASIL. *Amazonas.* Manaus, Fazenda do Prof. José Paulino, Cachoeira Baixa do Tarumã, 28.11.1983, *Vieira et al. 1072*, (INPA); lago de Paracuuba, rio Negro, proximidades de Manaus, 03.1969, *L. Coêlho s.n.*, (INPA 27330); rio Sumaúma, afluente do rio Negro, 06.04.1959, *L. Coêlho s.n., (INPA); rio Apuau, afluente do rio Negro, 18.08.1976, Ramos s.n.*, (INPA 62199); rio Solimões, lago Janauacá, braço do igarapé Itaúba, 04.07.1969, *Albuquerque 153*, (INPA); Manacapuru, estirão do Macumuri, 02.04.1957, *Rodrigues 375*, (IAN, INPA, US); Anori, embocadura do rio Purus, beira do Daoca, 02.04.1967, *M. Silva 758*, (MG, NY); Tefé, igapó abaixo do lago, 27.06.1906, *Ducke s.n.* (MG 7386); Alvarães, igarapé Aruã, 28.11.1982, *Cid et al., 3811*, (INPA); Maraã, rio Maraã, afluente do rio Japurá, s.d., *Mota 2534*, (INPA); Fonte Boa, 24.05.1945, *Fróes 20951*, (NY, US); São Paulo de Olivença, 03.1945, *Fróes 34842*, (IAN); Humaitá, próximo de Livramento, 12.10—06.11.1934, *Krukoff 6619*, (MO, NY, US); Maués,
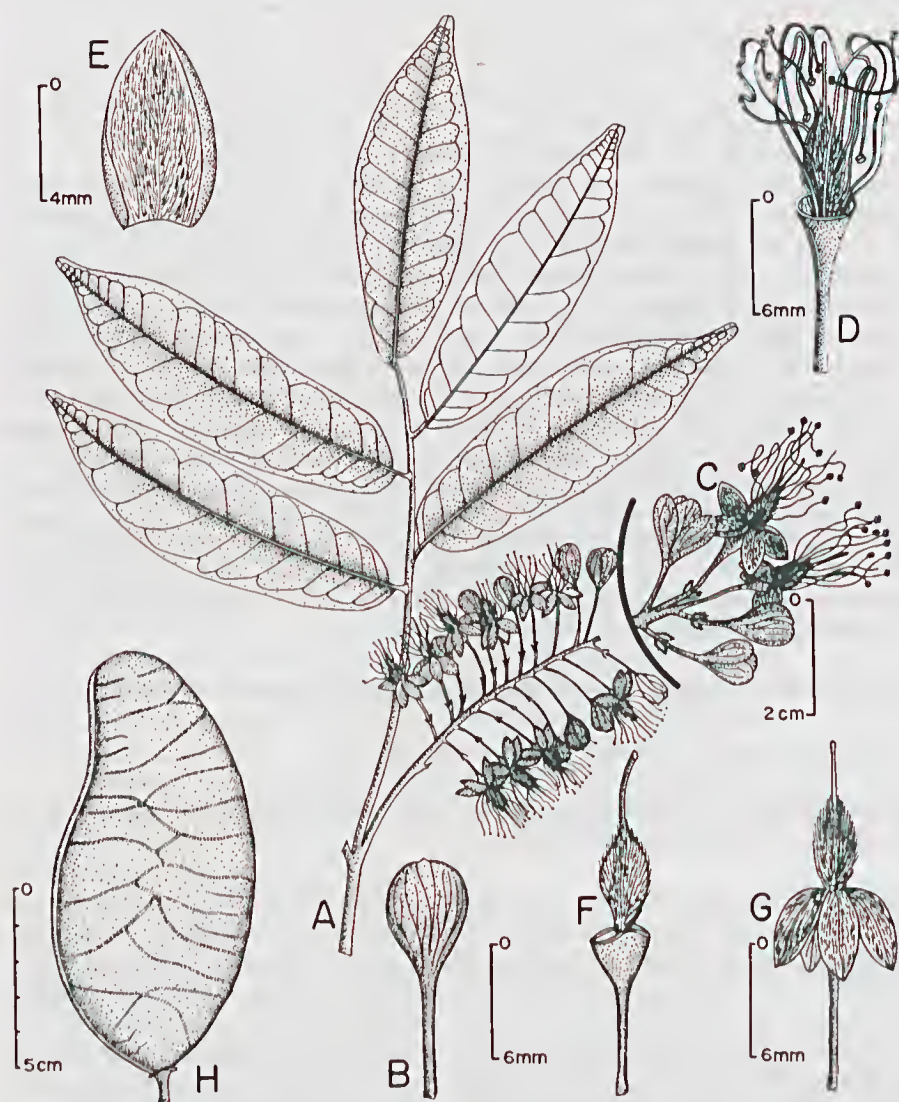
Figura 6 — *Crudia amazonica* Spruce ex Bentham (A-G, *Campbell et al. P22013*, MG; H, *Cid et al. 2393*, MG); A, ramo com inflorescência; B, botão floral; C, ápice da inflorescência em detalhe; D, gineceu e androceu; E, sépala; F, hipântio; G, gineceu com cálice; H, fruto imaturo.

igapó, 20.04.1974, *Campbell et al. P22013*, (MG, MO, NY, US); Parintins, lago Preto, Paraná do Ramos, 13.10.1957, *Fróes 33685*, (IAN); Camanaus, igarapé do Uniuá, 28.10.1978, *Nascimento 820*, (MG, NY, US); Santa Isabel do Rio Negro, 20—40 Km acima de Santa Isabel do Rio Negro, 15.10.1978, *Madison et al. 292*, (INPA); São Gabriel da Cachoeira, margem direita do rio Uaupés, localidade São Pedro, 07.12.1978, *Mota 3004*, (INPA). *Pará*. Óbidos, praia do lago Curumu, 03.01.1914, *Ducke s.n.*, (MG 15290); Almeirim, boca do Aramum, 05.07.1919, *Ducke s.n.*, (RB 10998); Oriximiná, lago do Iripixi, 13.01.1968, *M. G. Silva 1135*, (MG); Santarém, Cachoeira Capanema, 05.1850, *Spruce s.n.*, (RB 5163). *Rondônia*, Porto Velho ao longo do rio das Garças, 13.09.1963 *Maguire et al. 56695*, (NY, US). *Roraima*, Boa Vista, 08.1932, *Capucho, 412*, (IAN).

Crudia amazonica Spruce ex Bentham tem ampla distribuição na Amazônia brasileira. Segundo Ducke (1922, 1949), a espécie habita as margens arenosas de certos rios lentos e lagos de água limpa.

A espécie caracteriza-se por possuir inflorescência e flores maiores que outras espécies e folíolos numerosos e estreitos, glabros ou pubescente na face inferior.

É conhecida por diferentes nomes vulgares, tais como: "Faveira", "Lombrigueira", "Orelha-de-cachorro", "Aranani" e "Orelha-de-burro", no Amazonas, "Orelha-de-cachorro" e "Faveira-de-igapó", no Pará.

6. Crudia spicata (Aublet) Willdenow, Sp. Plant. 2:539.1799; Amshoff, Meded. Bot. Mus. & Herb. Rijks Univ. Utrecht 52:10, Fig. 1a. 1939, emend; G.J.H. Amshoff, Bol. Técn. Inst. Agr. do Norte 28:78.1953. Figura 7.

Apalatoa spicata Aublet, Hist. Pl. Guian Fr. 1:383, t. 147.
Tipo: *Aublet s.n.* Guiana Francesa, s.d., fl. (holótipo BM *n.v.)*.

Árvore até 16 m de altura raramente arbusto, copa ampla, córtex marrom-acinzentado ou marrom escuro, pubescente. Ramos cilíndricos, pubescentes, raramente glabros. Folhas alternas, pecioladas, 6—13 folioladas; estípulas côncavas, oblíquas, geralmente pubescentes, 10—20 mm de comprimento; pecíolos cilíndricos, pubescentes, 4—11 mm de comprimento; peciólulos pubescentes, 2—5 mm de comprimento; folíolos membranáceos ou cartáceos, ovados a oblongo-lanceolados, pubescentes em ambas as faces, raramente glabros, 6—11 cm de comprimento, 2—3.5 cm de largura, ápice agudo ou acuminado-caudado, base arredondada ou obtusa, margem inteira; nervuras primária ou secundárias impressas na face superior e proeminentes na inferior; nervuras secundárias 7—11 pares, arqueado-ascendentes, anastomosando-se a 2—3 mm da margem. Inflorescência racemosa, axilar ou terminal, 10—12 cm de comprimento; pedúnculo e pedicelos pubescentes; pedicelos, 3.5 mm de comprimento; bractéolas pedicelares, membranáceas, ovais, pubescentes, 8—15 mm de comprimento por 4—8 mm de largura, ápice agudo, base obtusa; bractéolas próximas ao cálice ovais, membranáceas, pubescentes, 4—8 mm de comprimento, 3—4 mm de largura, ápice agudo, base obtusa; flores brancas a esverdeadas; cálice, 4 sépalas, membranáceas, ovais, pubescentes, 4.5—10 mm de comprimento, 4—7 mm de largura, ápice agudo ou agudo-acuminado, base obtusa, margem inteira; hipântio caliciforme, 1—1.5 mm de comprimento; filetes glabros, 8—10 mm de comprimento; anteras elíptico-lanceoladas, 2—3 mm de comprimento, deiscência rimosa, dorsifixas; gineceu, 7—10 mm de comprimento; ovário ovóide,
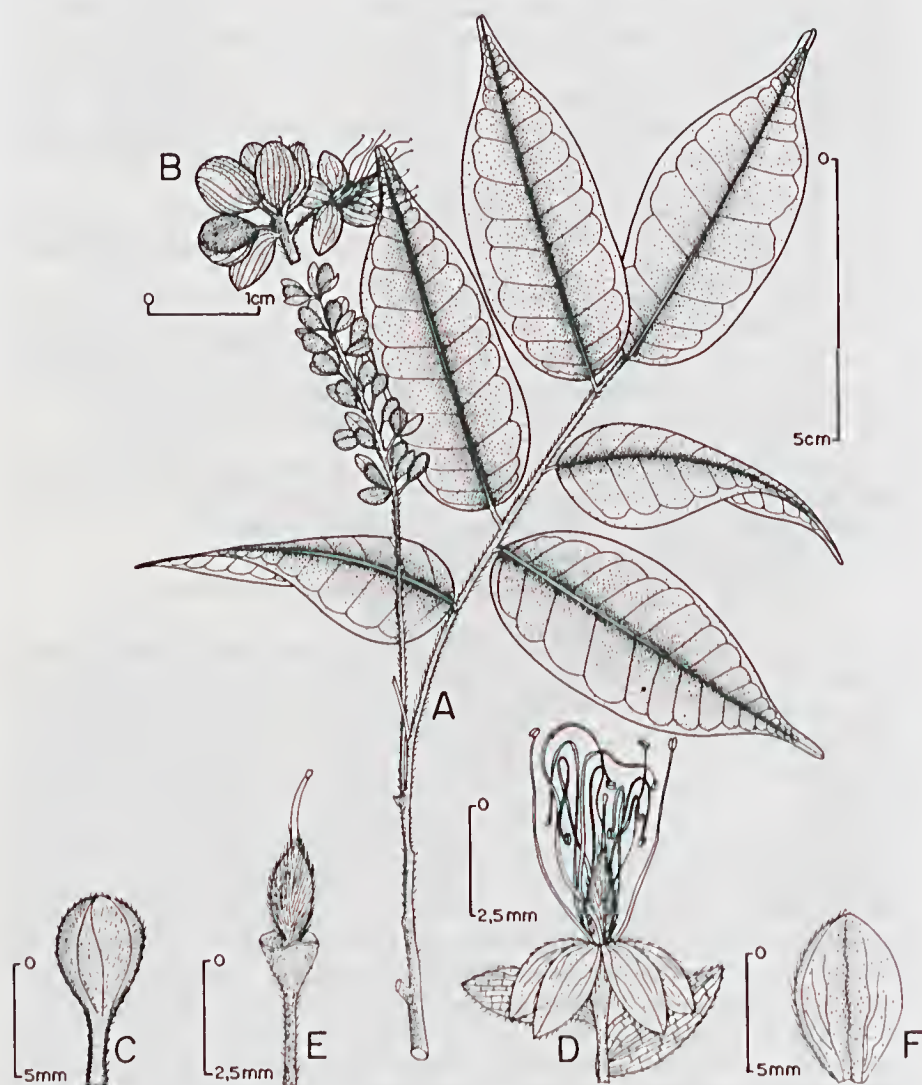
Figura 7 — *Crudia spicata* (Aublet) Willdenow (A-F, *Huber s.n.*, US 1442206): A, ramo com inflorescência; B, ápice da inflorescência em detalhe; C, botão floral; D, flor e bractéolas; E, hipântio; F, sépala.

Figura 8 — Distribuição geográfica de: *Crudia amazonica* Spruce ex Bentham; * *Crudia glaberrima* (Steudel) Macbride; *Crudia spicata* (Aublet) Willdenow na Amazônia brasileira.

subséssil, 5—6 mm de comprimento, 2—3 mm de diâmetro, 2—4 - ovulado, densamente tomentoso; estilete glabro, 10 mm de comprimento; estigma ligeiramente dilatado. Fruto, vagem oval-arredondada, estipitada, tomentosa quando jovem, depois glabra (Roosmalen 1985).

Distribuição geográfica: Brasil, Pará. Figura 8.
Fenologia: Floresce em janeiro e julho; frutificação: não registrada.

Habitat: Margens de rios, terrenos inundados e mata de várzea estacional.

Espécimes examinados: BRASIL. *Pará*. Belém, Horto Botânico, 11.07.1927, *Ducke s.n.*, (RB 1421553, US 1442206).

Crudia spicata (Aublet) Willdenow ocorre no Pará, nas margens do rio Mapuera (alto Trombetas), em Belém, nos terrenos inundados e cultivada no Horto do Museu (Ducke 1915). Encontra-se também no rio Aramá (Breves), beira do rio Mapuera e na Guiana (Ducke 1925).

Morfologicamente, *Crudia spicata* (Aublet) Willdenow é muito parecida com *Crudia bracteata* Bentham, sendo colocada várias vezes como sinônimo da espécie. Distingue-se pelos folíolos ovados a oblongo-lanceolados, pubescentes, estípulas membranáceas e de maior tamanho, racemos pubescentes, ovário tomentoso e fruto estipitado, tomentoso quando jovem, tornando-se depois glabro.

A espécie é conhecida como, "Ipê" ou "Ipe-rana", no Pará (Breves).

7. *Crudia pubescens* Spruce ex Bentham in Martius, Fl. Bras. 15 (2): 240. 1870. Figura 9.

Tipo: *R. Spruce* 2411. Brasil. Amazonas, São Gabriel da Cachoeira, agosto 1852, fl. (holótipo K *n.v.;* isótipo RB). *R. Spruce 1673.* Brasil. Amazonas, foz do rio Negro, igapó, agosto 1852, fl. (parátipo K *n.v.;* isoparátipo RB; foto do tipo F, MO, NY, RB, US).

Apalatoa pubescens (Bentham) Taubert, Bot. Centralbl. 43. 394.1891.
Crudia oblonga sensu Amshoff, Meded. Bot. Mus. & Herb. Rijks Univ.Utrecht 52:13.1939; non Bentham.

Árvore de até 20 m de altura. Copa ampla, córtex dos ramos marrom-acinzentado ou marrom-ferrugíneo. Ramos cilíndricos, estriados, pubescentes. Folhas alternas, pecioladas, 6—9 folioladas; estípulas elípticas, lanceoladas, pubescentes, decíduas, 6—10 mm de comprimento por 1—2 mm de largura; pecíolos cilíndricos, estriados, pubescentes, 4—10 mm de comprimento; peciólulos pubescentes, 2—3 mm de comprimento; folíolos elípticos ou obovados, pubescentes em ambas as faces, 3—10 cm de comprimento por 2—6 cm de largura, ápice agudo ou acuminado e às vezes retuso, base arredondada, pouco oblíqua, margem inteira; nervuras primária e secundárias impressas, fracamente na face superior, na inferior proeminentes, nervuras secundárias 7—12 pares, arqueado-ascendentes. Inflorescência racemosa, axilar ou terminal, 3—12 cm de comprimento; pedúnculo e pedicelos pubescentes, pedicelos, 5—10 mm de comprimento; bractéolas pedicelares membranáceas, lanceoladas, pubescentes, 1—2 mm de comprimento por 0.5 mm de largura; bractéolas próximas ao cálice membranáceas, elípticas ou lanceoladas, pubescentes, 1—3 mm de comprimento por 0.5 mm de lagura, decíduas; flores brancas a esverdeadas; cálice, 4 sépalas membranáceas, oblongas a oblongo-lanceoladas, pubescentes em ambas as faces, 4.7—8.5 mm de comprimento por 6—6.5 mm de largura, ápice agudo a

Figura 9 — *Crudia pubescens* Spruce ex Bentham (A–F, *Ducke 17222*, G, Pessoal da Fisiologia do INPA *s.n.*): A, ramo com inflorescência; B, ápice da inflorescência em detalhe; F, botão floral e bractéolas; G, fruto maduro mostrando as sementes.

obtuso ou arredondado, base obtusa ou arredondada; hipântio caliciforme, 1.5—2 mm de comprimento; androceu, 10 estames, exsertos, 12—13 mm de comprimento; filetes, 9—11 mm de comprimento, glabros; anteras oblongas a elípticas, 2—3 mm de comprimento, deiscência rimosa, dorsifixas; gineceu, 14 mm de comprimento; ovário ovóide subséssil, densamente rufo-hirsuto, 8 mm de comprimento por 3 mm de diâmetro, 2—4 ovulado; estilete glabro, 7 mm de comprimento; estigma ligeiramente dilatado. Fruto, vagem oval, plana, marrom tomentosa, nervuras salientes rugosas, 8—17 cm de comprimento por 4.5—6 cm de largura; semente, 1—6 por fruto, de formas variáveis 3—6.5 cm de comprimento por 3—6 cm de largura.

Distribuição Geográfica: Brasil: Amapá, Amazonas, Pará. Figura 11.

Fenologia: Floresce de agosto a dezembro; frutifica de janeiro a dezembro.

Habitat: Mata de várzea estacional e mata de igapó estacional e permanente.

Espécimes examinados: BRASIL. *Amapá*. Margem esquerda do rio Amapari, 2—3 milhas acima da Serra do Navio, 70—300 m de altitude, 23.11.1954, *Cowan 38531*, (US); rio Oiapoque, margem do rio, 2—5 Km ao sudeste da foz do Ingarari, 2°17'—18'N, 52°39—41'W, 18.09.1960, *Irwin et al. 48339*, (NY, UB, US). *Amazonas*, margem do rio Negro. Levantamento do Projeto Radam, quadrícula SA—20—ZD, 06.12.1973, *Pena 438*, (IAN); rio Uatumã, Km 4 da cachoeira, 20.02.1978, *Lisboa et al. 1124*, (INPA); Itapiranga, rio Uatumã, ao longo do rio, margem esquerda, 10.08.1979, *Cid et al. 147*, (INPA, NY); Parintins, Mamuru, 11.02.1957, *Fróes 33121*, (UB). *Pará*. Belém, IAN, 02.01.1943, *Archer 8094*, (NY, US); Gurupá, 17.08.1918, *Ducke 17222*, (R); Santarém, 19.08.1916, *Ducke s.n.*, (MG 16360, US 1044188).

Crudia pubescens Spruce ex Bentham, segundo Ducke (1922, 1925) é freqüente em toda a região dos furos de Breves; Gurupá: riacho nas imediações do Amazonas; Santarém: praia baixa da cidade; Faro, boca do lago Maracanã. Bentham (1870) e Ducke (1925) citam a ocorrência da espécie na Guiana Francesa.

Crudia pubescens foi considerada por Amshoff (1939) e Sandwith (1948) como sinônimo de *Crudia oblonga*, no entanto discordamos dos autores, porque a espécie-tipo de *Crudia pubescens*, coletada por *Spruce 2411* (K), é originária do rio Negro, Amazonas e a de *Crudia oblonga* foi coletada por *Martin s.n.* (K), na Guiana Francesa. Morfologicamente, *Crudia pubescens* distingue-se de *Crudia oblonga* pelos folíolos obtusos, um pouco mais largo e pubescentes em ambas as faces e o fruto com ápice acuminado.

A espécie é conhecida como: "Jutahy-rana", no Pará (Belém), "Ipê", "Ipê-rana ou Iperana" e "Jutairana", em Breves.

8. Crudia oblonga Bentham, Bot. Voy. Sulph. 4:1844; Grisebach, Fl. W. Indies. 216. 1860; Bentham in Martius, Fl. Bras. 15 (2): 238.1870. Figura 10.

Tipo: *Martin s.n.* Guiana Francesa. Caiena, 1842, Fl (holótipo K *n.v.;* isótipo P *n.v.;* foto do tipo K).

Apalatoa oblonga (Bentham) Taubert, Bot. Centralbl. 47:394.1891.

Crudia pubescens sensu Amshoff, Bol. Técn. Inst. Agron. Norte. 28:81.1953, non Bentham.

Apalatoa pubescens (Bentham) sensu Amshoff, Bol. Técn. Inst. Agron. Norte. 28:81.1953, non Taubert.

Árvore de até 37 m de altura, raramente arbusto, copa ampla bastante ramificada e pouco densa, córtex dos ramos marrom-acinzentado ou marrom-escuro, estriado. Ramos cilíndricos, estriados pubescentes. Folhas alternas, pecioladas, 4—9 folioladas; estípulas elípticas, lanceoladas, geralmente pubescentes, caducas ou decíduas, 5—10 mm de comprimento, 1—2 mm de largura; pecíolos cilíndricos, estriados, pubescentes, 2—5 mm de comprimento; folíolos membranáceos, oblongos a oblongo-lanceolados, pubescentes nas duas faces e às vezes glabros na face superior, 4—15 cm de comprimento por 2—4.8 cm de largura, ápice obtuso-acuminado ou às vezes arredondado, base oblíqua ou obtusa, margem inteira; nervuras primária e secundárias impressas, fracamente reticuladas na face superior, na inferior proeminentes; nervuras secundárias 7—8 pares, arqueado-ascendentes. Inflorescência racemosa, axilar ou terminal, 5—17 cm de comprimento; pedúnculo pubescente; pedicelos pubescentes, 6—12 mm de comprimento; bractéolas próximas ao cálice, membranáceas, elípticas, pubescentes, 1—2 mm de comprimento por 0.5 mm de largura, precocemente caducas; flores verde-amareladas a amarelo-amarronzadas; cálice, 4 sépalas membranáceas, obovadas a oblongo-lanceoladas, glabras internamente e pubescente na face externa, 3—5 mm de comprimento, 1.5—2.5 mm de largura, ápice agudo-obtuso, base arredondada ou obtusa; hipântio caliciforme 1.5—2 mm de comprimento; androceu, 10 estames, exsertos, 12—14 mm de comprimento; filetes, 8—10 mm de comprimento, glabros; anteras oblongas e globosas, 1—3 mm de comprimento, deiscência rimosa, dorsifixas; gineceu, 13—14 mm de comprimento; ovário ovóide, subestipitado, densamente tomentoso, 8 mm de comprimento por 3 mm de diâmetro, 2—6 — ovulado; estilete parcialmente glabro, pubescente apenas na base, 5—7 mm de comprimento; estigma ligeiramente dilatado. Fruto, vagem, oblonga, obovada ou oblongo-lanceolada, clavada às vezes, falcada, comprimida, oblíqua, subestipitada, rígido-coriácea, superfície reticulada, seríceo-tomentosa, pêlos marrons, nervuras transversais salientes, rugosas, 7—17 cm de comprimento por 4—6 cm de largura, suturas marginais espessadas, na face ventral ondulada; semente, 1—3 por fruto, orbiculares, oblongas ou subreniformes comprimidas, 4.5—6 cm de comprimento por 3.5—5 cm de largura, testa membranácea, castanha; embrião com cotilédone carnoso, branco, crasso.

Distribuição geográfica: Brasil: Amapá, Amazonas e Pará. Figura 11.

Fenologia: Floresce de janeiro a novembro; frutifica de fevereiro a dezembro.

Habitat Mata de terra firme, mata de várea estacional, mata de igapó estacional e mata de várzea do estuário.

Espécimes examinados: BRASIL. *Amapá*. Rio Araguari, altitude de 135 m, 1°40'N — 51°56'W, 28.08.1961, *Pires et al. 50565*, (IAN, NY, UB, US); Serra do Navio, 25.09.1961, *Pires et al. 51212*, (INPA, UB); rio Oiapoque, 14.10.1950, *Fróes 26640*, (R, UB, US). *Amazonas*. Manaus, a leste da Ponta Negra, 1.02.1974, *Prance et al. 20180*, (INPA, MO, NY, US); Maués, praia alagável do rio, 30.11.1946, *Pires 149*, (NY); Parintins, lago Uaicurapá, margem (praia) inundável, 07.09.1932, *Ducke s.n.*, (RB 24284); Tapuruquara, rio Negro, ilha de Tamaquaré, 12.09.1979, *Kubistzki et al. 249*, (INPA). *Pará*, Horto Botânico, 01.1914, *Huber s.n.*, (MG 15327, RB 5632, US 10406331); rio Tajapuru, perto de Antônio Lemos, estreito de Breves, 27.09.1919, *Ducke s.n.*, (RB 11007); Margens do rio Piria, Sul da BR—22, 23.08.1964, *Prance et al. 58829*, (NY, UB, US); Óbidos, 12.08.1916, *Ducke s.n.*, (MG 15919, RB 11008); rio Xingu, em frente a Souzel, 17.11.1955, *Fróes 32322*, (IAN); Santarém, Belterra. Estrada Porto Novo-Pindobal. Praia do

Figura 10 — *Crudia oblonga* (A—F, *N.T. Silva s.n.* (IAN) 136394; G, *Pires et al.* 51212): A, ramo com inflorescência; B, botão floral; C, gineceu com cálice; D, gineceu e androceu; E, sépala; F, hipântio; G, fruto imaturo.
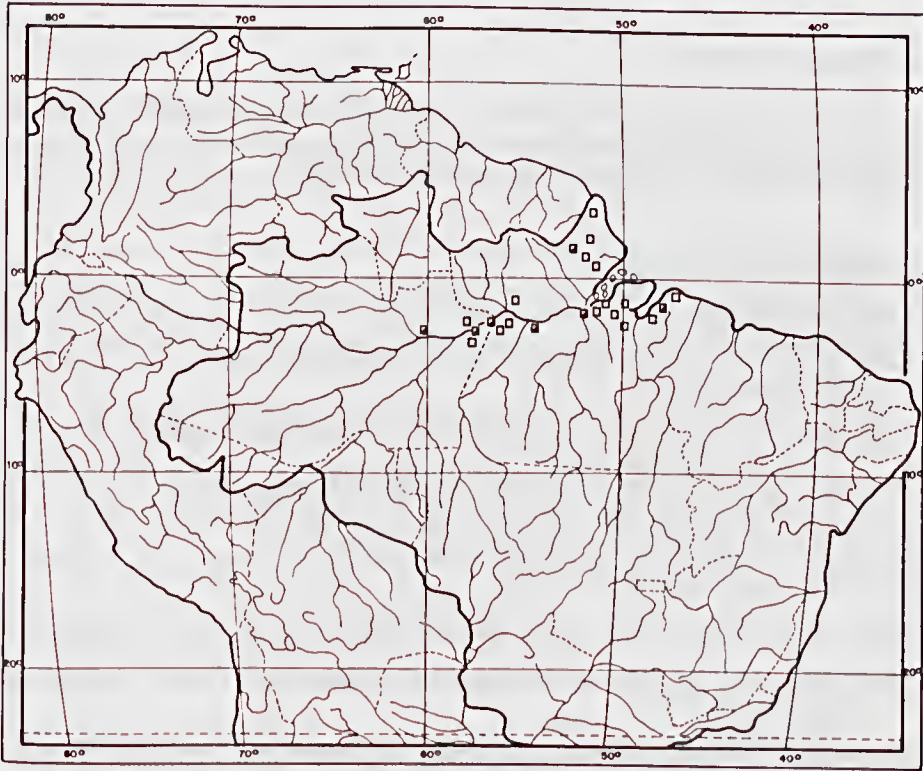
Figura 11 — Distribuição geográfica de: □ *Crudia pubescens* ex Bentham; ◩ *Crudia oblonga* Bentham na Amazônia brasileira.

rio Tapajós, 07.12.1978, *Vilhena et al. 130*, (NY); Margem do rio Arapiuns, 09—15.11.1952, *Pires et al. 4354*, (IAN, NY).

Crudia oblonga Bentham ocorre na Guianà francesa, Brasil, Amazônia e também na Guiana, segundo Sandwith (1948). Amshoff (1953) cita que a espécie foi coletada na Guiana e que nenhuma coleção foi conhecida no Suriname.

A espécie difere de *Crudia pubescens* pelos folíolos obtusos curtamente acuminados e pubescentes nas duas faces quando glabros somente na face superior e o fruto tem o ápice obliquamente acuminado ou arredondado.

É conhecida como: "Ipê-rana", no Pará (Belém).

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MATERIAES[1] PARA A FLORA AMAZÔNICA — VIII. Contribuição à Sistemática das Linaceae da Amazônia Brasileira[2]

Ricardo de S. Secco[3]
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RESUMO — Este trabalho apresenta alguns aspectos sistemáticos da família Linaceae. No Brasil, a Amazônia destaca-se como centro de distribuição geográfica, com três gêneros: Hebepetalum, Roucheria *e* Ochthocosmus. *Pouca atenção tem sido dada à sistemática desta família na região amazônica, o que provoca certos equívocos como, por exemplo, a sua posição sistemática que, muitas vezes, é incluída no grupo das Humiriaceae. Na Amazônia Brasileira* Hebepetalum *está representado por* H. humiriifolium *e uma espécie possivelmente nova;* Roucheria *por três espécies:* R. calophylla, R. punctata *e* R. schomburgkii; Ochthocosmus *por duas espécies:* O. barrae *e* O. multiflorus. Rocheria *separa-se facilmente de* Hebepetalum *pela disposição paralela nas nervuras secundárias de suas folhas e pela ausência de pêlos na face interna das pétalas. Os frutos de* Ochthocosmus, *que são do tipo cápsula, separam-se facilmente dos de* Hebepetalum *e* Roucheria, *cujos frutos são do tipo drupa. Dados sobre pólen, importância econômica, distribuição geográfica de Linaceae e suas afinidades com as Humiriaceae são apresentados.*

PALAVRAS-CHAVE: Linaceae, Sistemática, *Hebepetalum*, *Roucheria*, *Ochthocosmus*, Humiriaceae.

ABSTRACT — This paper presents some aspects relevant to the systematics of the family Linaceae. In Brazil, the Amazon Basin is notable as the center of the family's distribution, with three genera: Hebepetalum, Roucheria *and* Ochthocosmus. *Little attention has been given to the systematic of this family in the Amazon, giving rise to certain doubts, such*

1 A palavra "materiaes" está grafada de modo arcaico, respeitando a proposta original de Huber.

2 Parte do trabalho foi apresentado no XLI Congresso Nacional de Botânica (Fortaleza-CE), 1990.

3 SCT/CNPq/Museu Paraense Emílio Goeldi.

4 Bolsista de Iniciação Científica CNPq/MPEG, processo no. 802186/88-2.

as, for example, the correct sistematic position of the Linaceae which has often been placed with the Humiriaceae. In the Brazilian Amazon Hebepetalum *is representedby* H. humiriifolium *and a possibly new species;* Roucheria *by three species:* R. calophylla, R. punctata *and* R. schomburgkii; *and* Ochthocosmus *by two species:* O. barrae *e* O. multiflorus. Roucheria *is easily separated from* Hebepetalum *based on the parallel arrangement of secondary veins in the leaves and the absence of hairs on the inside face of the petals. The fruits of* Ochthocosmus *are of the capsule type and are easily told from those of* Hebepetalum *e* Roucheria, *whose fruits are drupes. Data on pollen, economic importance, and geographical distribution of the Linaceae are presented, along with an evaluation of affinities with the Humiriaceae.*

KEY WORDS: *Linaceae, Systematic,* Hebepetalum, Roucheria, Ochthocosmus, Humiriaceae.

INTRODUÇÃO

Dando prosseguimento à série "Materiaes para a flora amazônica", proposta em 1898 pelo ilustre botânico Dr. Jacques Huber, fundador do herbário do Museu Goeldi, doravante serão apresentadas, em capítulos, novas contribuições mais detalhadas sobre os aspectos sistemáticos das plantas da Amazônia. Tem esta série, agora, como objetivo básico treinar estudantes de graduação e congregar os demais interessados no estudo da Sistemática Vegetal. Espera-se também contribuir para a identificação correta das espécies coletadas nos inventários florísticos regionais, já que a série procurará atualizar a nomenclatura dos "taxa" da Amazônia.

A família Linaceae, apesar de sua ampla distribuição no território brasileiro, especialmente na Amazônia, ainda não foi agraciada com um tratamento adequado para a identificação de seus gêneros e espécies da região. Abrange cerca de 17 gêneros e 250 espécies, distribuídos nos trópicos e regiões temperadas (Barroso 1984). De acordo com Cronquist (1981), Linaceae consta de 6 gêneros e cerca de 220 espécies, distribuídos nas regiões temperadas e subtropicais; dos gêneros aqui tratados cita apenas *Ochthocosmus*, mas para a família Ixonanthaceae.

Com base nos levantamentos realizados na literatura especializada, nos herbários do Museu Goeldi (MG), do INPA e da Embrapa (IAN), além de coletas nas áreas vizinhas à cidade de Belém e interior do Estado do Pará, verificou-se que os gêneros de mais comum ocorrência amazônica são *Hebepetalum, Roucheria* e *Ochthocosmus.* Este levantamento revelou que a sistemática das Linaceae ainda está bastante confusa e desatualizada, sendo muito comum encontrá-la identificada erroneamente nos herbários como Humiriaceae ou Ochnaceae. Também encontra-se o gênero *Roucheria* misturado com *Hebepetalum* e vice-versa.

Alguns autores como Macbride (1943) e Joly (1975) incluíram Humiriaceae entre as Linaceae, quando Planchon (1848) e Cuatrecasas (1961) já haviam justificado a separação das duas famílias.

Diversos autores dividiram Linaceae em subfamílias e algumas destas foram depois tratadas como famílias separadas, conforme pode se verificar citações em Saad (1962). Sobre este assunto não se entrou em detalhes na presente contribuição, visto estar fora do objetivo dos autores.

Uma considerável coleção de Linaceae, retida nos herbários do MG, IAN e INPA, permanecia mal identificada e não estudada, lacuna esta que se procurou suprir com a contribuição ora apresentada, enfocando espécies típicas da Amazônia brasileira.

NOTAS BÁSICAS SOBRE A HISTÓRIA DAS LINACEAE DO NEOTRÓPICO

Procura-se aqui fornecer um breviário da literatura sobre taxonomia de Linaceae, onde há referência direta aos gêneros amazônicos.

Bentham (1843) descreveu o gênero *Ochthocosmus*, estabelecendo a espécie *O. roraimae* procedente da Venezuela.

Roucheria foi descrito por Planchon (1847), que estabeleceu algumas espécies provenientes das Guianas e das Índias. Entre aquelas, ressalte-se as neotropicais *R. calophylla*, da Guiana e *R. humiriifolia*, de Caiena. O mesmo autor (1848) descreveu *R. schomburgkii*, da Guiana, colocando a espécie *R. humiriifolia* como duvidosa para o gênero *Roucheria*. Neste estudo, Planchon considerou a familia Humiriaceae como um grupo autônomo, independente das Linaceae, embora relacionando-as através do gênero *Roucheria*.

Bentham (1862), estudando a família Lineae (Linaceae), descreveu o gênero *Hebepetalum* baseando-se, ao que parece, em material proveniente da Guiana. Neste estudo, Bentham considerou Linaceae e Humiriaceae como famílias distintas.

Urban (1872) considerou Lineae (Linaceae) e Humiriaceae como famílias independentes, tratando para a primeira os gêneros Linum e Ochthocosmus.

Reiche (1896) tratou as Linaceae no Pflanzenfamilien, fazendo uma breve referência aos gêneros aqui estudados.

Huber (1907), na série "Materiaes para a flora Amazônica", capítulo VII, referiu-se às espécies *Hebepetalum humiriifolium* e *H. latifolium*.

Ducke (1932) descreveu as espécies *Hebepetalum parviflorum* e *H. punctatum*. O mesmo autor (1933) fez novas combinações, considerando *Roucheria schomburgkii* como *Hebepetalum schomburgkii*, referindo-se a *Ochthocosmus roraimae* para Manaus e considerando Linaceae e Humiriaceae como famílias distintas.

Ducke (1937) transferiu *Hebepetalum punctatum* e *H. parviflorum* para o gênero *Roucheria*, estabelecendo as novas combinações *R. punctata* e *R. parviflora*; também descreveu a espécie *Ochthocosmus multiflorus* para o Estado do Amazonas.

Ducke (1947) estabeleceu a espécie *Roucheria elata*, proveniente de Leticia (Amazônia colombiana).

Macbride (1943), em seu trabalho sobre a flora do Peru, considerou Humiriaceae como sinônimo de Linaceae, tratando gêneros de ambas as famílias conjuntamente. De Linaceae "sensu strictu", o referido autor citou os gêneros *Linum, Hebepetalum* e *Roucheria.*

Cuatrecasas (1961), em uma revisão atualizada da família Humiriaceae, afirma que o referido grupo é bastante natural e perfeitamente separável das Linaceae, embora uma das maiores afinidades de Humiriaceae seja encontrada nos representantes lenhosos das Linaceae — na Amazônia, o parente mais próximo das Humiriaceae seria o gênero *Ochthocosmus*. Cuatrecasas salienta que uma das grandes diferenças entre as duas famílias é que Linaceae não possui óleos balsâmicos na casca e no

fruto, como os têm as Humiriaceae. O referido autor ressalta que tanto a morfologia do pólen como a anatomia da madeira não oferecem suporte suficiente para considerar as Humiriaceae junto às Linaceae.

Hutchinson (1967) abordou Linaceae independente das Humiriaceae, citando *Hebepetalum* e *Roucheria* como gêneros amazônicos.

Cronquist (1968) considerou Linaceae e Humiriaceae como famílias independentes.

Joly (1975) tratou as Humiriaceae como Linaceae, citando apenas *Ochthocosmus* entre os gêneros "linaceanos" típicos.

Roger & Smith (1975) trataram os gêneros *Cliococca* e *Linum*, ocorrentes ao sul do Brasil.

A revisão genérica mais recente sobre um representante das Linaceae é a de *Ochthocosmus*, feita por Steyermark & Luteyn (1980). Para a Amazônia brasileira, estes autores assinalaram *Ochthocosmus barrae* e *O. multiflorus*.

Barroso (1984) tratou Linaceae e Humiriaceae como famílias independentes.

Steyermark (1988) descreveu Ochthocosmus micranthus para a Venezuela.

Pólen

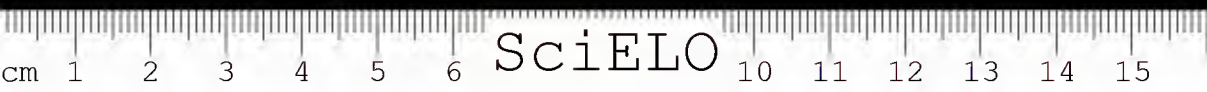
Estudos palinológicos na família Linaceae ainda são um tanto esparsos, sendo que pouco tem sido detalhado sobre as espécies da Amazônia.

Erdtman (1952) apresentou Linaceae como uma família euripalina (grãos de pólen heterogêneos). Em relação aos gêneros que ocorrem na Amazônia, Erdtman (1952) tratou apenas de *Ochthocosmus*, especialmente a espécie *O. africanus*, da África. Vale salientar que, de acordo com Steyermark & Luteyn (1980), *Ochthocosmus* é um gênero do neotrópico e as espécies do mesmo ocorrentes na África devem ser colocadas no gênero *Phyllocosmus*, segundo estudos detalhados de Forman apud Steyermark & Luteyn (1980). Saad (1961) discutiu as tendências filogenéticas do desenvolvimento da exina de algumas Linaceae, não fazendo qualquer referência às espécies da Amazônia. Ainda Saad (1962) apresentou um estudo detalhado sobre palinologia de Linaceae, sendo que da Amazônia tratou apenas *Hebepetalum humiriifolium* (Pl.) Bth. Para o referido autor, Linaceae seria uma família "primitiva" do ponto de vista da palinologia e tipicamente euripalina.

Bhoj, Raj & Suryakanta (1969) estudaram algumas espécies de Linaceae em microscopia de luz, sendo que do neotrópico trataram *Ochthocosmus barrae* Hallier, da Amazônia brasileira e *Roucheria laxiflora* Winkler, da Bolívia. Estes autores concordaram com Saad (1962), considerando Linaceae como uma família primitiva.

Em seguida serão apresentados alguns dados obtidos em microscopia de luz para complementar as observações de Erdtman (1952), Saad (1962) e Bhoj Raj & Suryakanta (1969). Espera-se que os referidos dados, aliados aos já existentes na literatura, possam contribuir, eventualmente, para esclarecer problemas taxonômicos e filogenéticos das Linaceae.

1. *Hebepetalum humiriifolium* (Planch.) Benth. (J.M. Pires 3297, IAN 63743)

Grãos médios, isopolares, simetria radial, subprolatos, âmbito circular, 3 — colpados, superfície reticulada. P = 60 ± 0,6 (56-64) μm. E = 48 ± 0,6 (42-56) μm; P/E = 1,25 μm; NPC = 344.

2. *Ochthocosmus barrae* Hallier (A.S.L.Silva et al 325, MG 72591).

Grãos grandes, isopolares, simetria radial, prolatos, âmbito triangular, 3 — colporados, superfície reticulada, P = 76± 1,6 (58-90) μm; E = 52± 2,1 (42-68) μm: P/E = 1,46 μm, NPC = 345.

3. *Roucheria calophylla* Planch (M.F. Silva et al. 1663, MG 50381)

Grãos grandes, isopolares, simetria radial, oblato esferoidal, âmbito circular, 3 — colpados, superfície punctada. P = 52± 0,4 (48-58) μm; E = 54± 0,4 (50-60) μm; P/E = 0,96 μm; NPC = 344.

4. *Roucheria punctata* Ducke (A. Ducke 1436, IAN 10874)

Grãos médios, isopolares, simetria radial, subprolatos, âmbito circular, 3 — colpados, superfície reticulada. P = 49± 1,6 (40-74); E = 39± 1,0 (28-54); P/E = 1,25 μm; NPC = 344.

5. *Roucheria schomburgkii* Planch. (G.T. Prance et al. 3612)

Grãos pequenos, isopolares, simetria radical, oblato-esferoidal, amb. circular, 3-colpados, superfície reticulada. P = 46± 0,3 (44-50) μm. E = 46± 1,8 (42-52) μm. P/E = 0,9 μm NPC = 343.

Relações taxonômicas e evolutivas

De acordo com Hutchinson (1967), *Hebepetalum* e *Roucheria* pertencem à tribo Hugonieae, que é aquela que engloba os gêneros filogeneticamente mais antigos das Linaceae, por apresentarem estames em dobro ou sempre mais numerosos que o número de pétalas.

Do ponto de vista fenético, há uma certa afinidade entre *Hebepetalum* e *Roucheria*, principalmente através de *R. punctata*, o que muitas vezes acasiona identificá-los erradamente. No entanto, em um exame mais detalhado, os dois gêneros separam-se perfeitamente pelo tipo de nervura foliar e morfologia floral. Considerando os princípios de Bessey (1915), podemos admitir que o caráter nervura paralela das folhas de *Roucheria* seja um caráter mais evoluído, em contraste com nervura reticulada (conforme encontra-se em *Hebepetalum*).

Por apresentar o número de estames igual ao de pétalas, *Ochthocosmus* enquadra-se na tribo Lineae, citada por Hutchinson (1967) como um grupo mais recente das Linaceae. *Ochthocosmus* é perfeitamente separável de *Hebepetalum* e *Roucheria* por apresentar o fruto em cápsula, cárater este que talvez possa ser considerado primitivo, caso se leve em conta Webster (1984) que apontou para o gênero *Flueggea* Willd. (Euphorbiaceae) fruto capsular como primitivo e fruto indeiscente ou baga como avançado. Quanto ao caráter número de estames (apenas cinco) e morfologia polínica (grãos de pólen colporados), *Ochthocosmus* apresenta-se como um gênero evoluído em relação a *Hebepetalum* e *Roucheria* (ambos com dez estames e grãos de pólen colpados).

As observações aqui registradas sobre as relações evolutivas dos gêneros amazônicos das Linaceae são de caráter hipotético, e precisarão ser melhor aperfeiçoadas no decorrer de novas pesquisas que faremos sobre esta família, destacando-se uma revisão do gênero *Roucheria* para o neotrópico.

Diferenças entre Linaceae e Humiriaceae

Com o objetivo de consolidar as diferenças entre Linaceae e Humiriaceae da Amazônia, apresentamos alguns aspectos morfológicos dos gêneros amazônicos de Humiriaceae, que poderão ser comparados àqueles apontados para os gêneros de Linaceae no decorrer do texto.

Os dados apresentados baseiam-se em análise de material herborizado (MG) e em Cuatrecasas (1961).

1) Nº de estames: *Humiriastrum*, *Schistostemon*, *Humiria* (20), *Endopleura* (27), *Vantanea* (65-120), *Sacoglottis* (10). Linaceae tem no máximo 10 estames.

2) Concectivo espessado, bem pronunciado. As tecas das anteras são minúsculas em relação ao conectivo. *Endopleura* tem antera com 4 tecas. Linaceae não apresenta esse tipo de conectivo.

3) Presença de disco no ovário: *Humiriastrum* e *Schistostemon* (denteado), *Humiria* e Endopleura (laciniado) *Sacoglottis* e *Vantanea* (cupuliforme). Linaceae não apresenta disco no ovário.

Importância Econômica

Em geral a literatura fornece dados de uso apenas do gênero Linum, destacando-se o óleo de linhaça e as fibras.

Record & Hess (1949) registram que as madeiras de *Hebepetalum*, *Roucheria* e *Ochthocosmus* são duras e pesadas. Assim, é provável que sejam pouco atacadas por insetos e de boa *durabilidade*, portanto úteis.

Um estudo mais pormenorizado sobre as propriedds das madeiras de *Hebepetalum* e *Roucheria*, cuja distribuição é considerável na Amazônia, já se faz necessário. Basta dizer que no Catálogo de Madeiras da Amazônia (Loureiro & Silva 1968), que é o compêndio mais atualizado das madeiras da região, não há nenhuma referência ao grupo das Linaceae.

TRATAMENTO SISTEMÁTICO

Linaceae Lindl. — S. F. Gray, Nat. Arr. Brit. P1.2:639.1821 (descrita como "Lineae").

Ervas anuais ou perenes, arbustos ou árvores. Folhas alternas ou opostas, simples, estipuladas ou não, estípulas caducas. Flores andróginas, actinomorfas, dispostas em fascículos axilares, racemos ou cimeiras; sépalas 4-5, livres ou parcialmente concrescidas na base, imbricadas; pétalas livres, com ou sem apêndices na base; estames iso ou diplostêmones com filetes concrescidos na base; anteras introrsas, 2 — loculares; ovário súpero, tri a pentaloculado, um a dois óvulos pêndulos por lóculo, estilete 1,3 ou 5-fido, livre ou colunar. Fruto drupáceo, indeiscente ou cápsula septicida; semente alada ou não, endosperma abundante, escasso ou ausente, embrião reto com cotilédones achatados.

Gênero — tipo: *Linum* Lin., das regiões temperadas e subtropicais do Velho Mun-

do, principalmente do hemisfério norte, especialmente a leste do Mediterrâneo. Na Amazônia Brasileira, de acordo com o Dr. Murça Pires (com. pessoal), este gênero foi coletado em Roraima.

CHAVE PARA OS GÊNEROS AMAZÔNICOS

1. Estames 5, estilete colunar; fruto cápsula-septicida.............. *Ochthocosmus*
1. Estames 10 ou mais, estiletes 3 a 5, livres entre si; fruto drupáceo.
    2. Folhas reticuladas; flores com pétalas fartamente barbadas internamente, base unguiculada..*Hebepetalum.*
    2. *Folhas com numerosas nervuras secundárias paralelas entre si; flores com pétalas glabras, base não unguiculada.........................Roucheria.*

Hebepetalum Benth., Benth. & Hook. f. Gen. P1: 1.244. 1862.

Gênero monotípico..., cuja distribuição geográfica é tipicamente amazônica, especialmente no Estado do Pará, também abrangendo Amapá, Roraima, Amazonas, Mato Grosso, Rondônia, Suriname e Venezuela, nos ambientes de mata de terra firme, campina, campinarana, ocasionalmente em campo e cerrado. (Figura 1).
Etimologia: Hebe = a deusa da juventude; petalum = pétala.

Espécie-tipo: *Hebepetalum humiriifolium* (Planch.) Benth.

Hebepetalum humiriifolium (Planch.) Benth *in* Benth. & Hook. f., Gen. P1. 1:244. 1862., Index Kew 1:1097. 1893. (Figura 2)

Roucheria humiriifolia Planch. in Hook. Lond. Journ. Bot. 6:143, 1847. Tipo: "*in* Cayena. c1. Martin. in herb. Hook." (isótipo K, foto do isótipo MG)

Árvore 5-36 m X 2,5 — 60 cm ramo cilíndrico, glabro, tronco liso, esguio, raiz tabular. Folha alterna, oblonga, oblongo-lanceolada ou obovada, limbo 3 - 24,5 X 1 - 9 cm, glabro, nervação reticulada, dicotômica, nervura central raro pilosa, bordo crenado, àpice cuspidado ou retuso, base atenuada, pecíolo 0,4 - 3 cm, glabro, raro piloso. Inflorescência paniculada composta, 3,5 - 14 X 1,5 - 10 cm, terminal e axilar, pedúnculo piloso, bráctea e bractéola 1 mm de comprimento, lanceoladas, caducas, margens pilosas. Flor 3,6 - 5 X 3 - 4 mm, cálice 2 - 8 X 1 - 4; mm. pentâmero, zigomorfo, sépala 2 - 3 X 1,2 mm, 2 lanceoladas e 3 obovadas, carenadas, superfícies glabras, margens pilosas, corola 3 - 5 X 2 - 5 mm, zigomorfa, pétala 4 - 5 X 1 - 1.5, lanceolada, surperfície interna barbada, superfície externa e margens glabras; estames 10, soldados em volta do ovário, heterodínamos, 2 - 5 mm de comprimento, excertos, antera 0,5 mm de comprimento, sagitada, rimosa, dorsifixa; ovário 1 - 2 X 1 mm, ovado, 5 — carpelar, 5 — locular, 1 óvulo por lóculo, piloso no ápice, estilete ca. 1 mm de comprimento. 5-fidus, estigmas lobados. Fruto drupa, ovóide 5 - 8 X 4 mm, sementes 5, elíticas, embrião reto com endosperma.

MATERIAL EXAMINADO: VENEZUELA. T.F.Delta Amacuro *Berti* 444, nov-dez, 1964, fr (MG). SURINAME. Wayombo R., concession Venloo E of Dondekreek, *Schulz* 7348, nov. 1956, fl (MG): *Koeleroe* 234. set. 1944, fr (IAN) *Stahel* 26, sep. 1942, bot (IAN). BRASIL. Amapá, entre Porto Platon e Serra do Navio, *Rosa*, 113, out-dez. 1976, est (MG); Rio Falcino, *Pires et al.* 50931, set. 1961, fr (MG): Oiapoque, *Daly* e *Souza*

3826, dez. 1984, fr (MG); Rio Muturá, *Irwin et al.* 48441. set. 1960, bot (MG); Oiapoque, *Mori et al.* 17187, dez 1984, fr (MG); Macapá, *Mori* e *Cardoso* 17716, jan. 1985, fl (MG); Macapá, *Mori* e *Cardoso* 17723, jan. 1985, fl (MG); Oiapoque, *Daly et. al.* 3812, dez, 1984, fr (MG); Macapá, *Rabelo et al.* 3210; jan. 1985, fr (MG); Rio Muturá, *Irwin et al.* 48441, set. 1960, fl (IAN). Amazonas, rodovia Manaus-Porto Velho Km 240. *Lleras et al.* P19617, nov. 1973, fr (MG); Serra Aracá, *Rodrigues et al.* 10639, mar. 1984, fr (MG); estrada Humaitá-Lábrea Km 60, *Prance* 3285, nov. 1966 fr (MG); Borba, rio Madeira, *Cid* 3846, mar, 1983, fr (MG); estrada Manaus-Porto Velho Km 245, *Prance et al.* 20455, mar. 1974, fr (MG); Caracuari, *Silva et al.* 901, jul. 1980, est. (MG); Humaitá, *Krukoff* 7048, nov. 1934, est. (IAN); Codajás, Rio Capitari, *Fróes* 26524, set. 1950, bot (IAN); Pará. Alto Ariramba. *Ducke*, s.n., dez. 1906, fr (MG); Serra do Ariramba, *Ducke* s.n., dez. 1910, est. (MG); Serra do Dedal, Faro, *Ducke* s.n., set. 1907, est. (MG); Belém, campo Lyra Castro, *Ducke* 829, nov. 1941, fl (MG); Santa Isabel. *P.D.M.*, set. 1908, fr (MG); Belém. Hospital Dom Freire, *Huber* s.n., nov. 1903. bot. (MG); Belém, Hospital Dom Freire, *Goeldi* s.n., fev. 1905, bot. (MG); *Huber* s.n., jul. 1901, fr (MG); estrada Cuiabá-Santarém, Km 831, *Kirkbride Jr.* & *Lleras* 2838, fev. 1977, fr. (MG); Itaituba, estrada Santarém-Cuiabá Km 816, Silva et al. 151, abr. 1983, fr (MG); Belém, mata do IAN, *Guedes* 243. jan. 1950, fr (IAN); estrada Capanema-Maranhão Km 96. *Prance e Pennington* 1592, out. 1965. fr (IAN); Breves, *Pires* et al. 5617. jul. 1956, fr (IAN); mata da Pirelli. *Pires* 6916, jul. 1958, fr (IAN); Belém, Bosque Municipal, *da Silva* 18, jul. 1947, fl (IAN); Belém, Reserva do Mocambo, *Pires* & Silva *10645, jul. 1967, fr (IAN): Belém, Reserva do Mocambo, Pires* 12190, out. 1968, fr (IAN); Mosqueiro, *Oliveira* 5554, mar. 1971, est. (IAN); Mosqueiro, *Oliveira* 5700, mai. 1971, est. (IAN); Belém, campo Lyra Castro, *Ducke* 829, nov. 1941, fl (IAN); Belém, próx. a São Joaquim, *da Silva* 112, set. 1942, fr (IAN); Belém, *Pires* 3287, jun. 1951. fl (IAN); rodovia Belém-Brasília, Km 62 1/2, *Oliveira* 267, dez. 1959, fr (IAN); *Pires* 7278 est. (IAN). Rondônia. Vilhena, *Vieira* et al. 815, out. 1979, fl (MG); rio Abunã, *Prance* et al. 8545, nov. 1968, fr (MG); Vilhena, *Santos* et al. 854, mai. 1984, est. (MG); Vilhena, *Vieira* et al., nov. 1979, fr (MG); RO-429, Km 105, *Silva* 6551, jul. 1983, fr (MG); Vilhena, *Vieira* 854, nov. 1979. fr (MG). Mato Grosso, Aripuanã, *Silva* e *Rosário* 4731, mai. 1979. fl (MG); Sinop-Colider, *Cid Ferreira* et al. 6320. out. 1985, fl (MG); Sinop-Colider, *Thomas* et al. 4161, out. 1985, bot (MG).

Pela forma da folha e disposição das nervuras secundárias, *H. humiriifolium* está próxima do gênero *Roucheria*, principalmente através da espécie *R. punctata*. Entretanto as duas espécies separam-se facilmente pelo caráter da nervura, que em *H. humiriifolium* é reticulada e em *R. punctata* é paralela. *H. humiriifolium* apresenta as pétalas densamente barbadas e ovário 5 - locular, com ápice piloso, enquanto *R. punctada* apresenta pétalas glabras e ovário 1 — locular, glabro.

O nome *Hebepetalum humiriifolium* é aqui mantido, seguindo suas citações na literatura especializada como em Hutchinson (1967) e Huber (1907). Entretanto, Bentham (1862) não associou *Roucheria humiriifolia* Planch. ao nome do gênero *Hebepetalum*, uma vez que ao descrever *Hebepetalum* fez a seguinte citação: "Species 2, in Guiana V. Brasília boreali crescentes. (*Roucheria? humiriifolia*. Planch., et *R. latifolia*. Spruce)".

Uma vez que *Roucheria humiriifolia* Planch. é um nome legítimo, pois foi publicado por Planchon no periódico Hook. Lond. Jour. Bot. 6:143. 1847, acredita-se que esta

seja a razão de ter sido associado ao gênero *Hebepetalum*. No Index Kewensis (1893) a espécie vem citada como *H. humiriifolium* (Planch.) Benth, Ex Jackson. Mas de acordo com o Código Internacional de Nomenclatura Botânica (art. 33.3 e 44.1, 1988) a simples citação de um nome no Index Kewensis não tem valor nomenclatural. Portanto, o nome da espécie permanece *H. humiriifolium* (Planch.) Benth., sem levar em consideração o nome de Jackson. Já *Roucheria latifolia* é um nomem nudum, pois foi apenas citado por Bentham.

— Espécie possivelmente nova (nota prévia): *Hebepetalum roraimensis* Secco & Manni Silva, sp. nov. (?).

Tipo: Territ. Rio Branco (Roraima), road Boa Vista to Caracarahy. *R.L. Fróes 22926.* 01 de Fev. 1948. bot., fl. (Holotypus IAN). (Figura 1).

Arbor 4 m alta. Flores petalis intus sparse pilosis, stamina 10 antheris apice pilosis; ovarium 4 - loculare, stylo 4 - fido ramis tomentosis.

Esta espécie é aqui proposta com hesitação, uma vez que o material disponível ainda não é suficiente para consolidar o novo (?) táxon. Separa-se de *H. humiriifolium* pela quantidade de pêlos nas pétalas, anteras com ápice piloso, ovário 4 - locular e morfologia do estilete.

Ochthocosmus Benth., *in* Hook. Lond. Journ. Bot. 2:366 (1843).

Árvore ou arbusto, ramo cilíndrico, glabro. Folha alterna, obovada ou elíptica, limbo glabro, nervação reticulada, dicotômica, bordo inteiro ou crenado, com acúleos caducos nas reentrâncias, ápice retuso ou arredondado, base atenuada, pecíolo glabro. Inflorescência panícula terminal ou axilar, pedúnculo glabro, bráctea e bractéola presentes. Cálice pentâmero, zigomorfo, levemente soldado na base, sépalas ovadas ou lanceoladas, glabras, apresentam ou não ápice denteado, corola actinomorfa, pétala lanceolada, glabra; estames 5, livres, com as bases dilatadas ou gamostêmones, alternipétalos, heterodínamos, glabros, anteras elípticas ou lanceoladas, dorsifixas, rimosas, glabras; ovário 3-5 locular, 2 óvulos por lóculo, glabro, estilete terminal, glabro, estigma 5 - lobado. Fruto cápsula loculicida, ovado, sementes 2 por lóculo, aladas, oblongo-comprimidas, ala membranácea, embrião reto com endosperma.

Etimologia: Do grego *Oxthos* = colina, margem; Kosmos = adorno.

Gênero composto de 6 espécies (Steyermark & Luteyn 1980), com predominância de distribuição geográfica na Venezuela. Ocorre também na Amazônia brasileira, nos Estados do Pará, Amazonas, Mato Grosso e Rondônia.

Espécie — tipo: *Ochthocosmus roraimae* Benth.

CHAVE ARTIFICIAL PARA OCHTHOCOSMUS

1. Folha obovada, ápice retuso ou arredondo, bordo crenado com acúleos nas reentrâncias; panícula axilar, sépalas com ápice inteiro, estames levemente soldados, com bases dilatadas..*O. barrae.*
1. Folha elíptica, ápice arredondado, bordo inteiro ou com ligeiras ondulações; panícula terminal; sápalas com ápice levemente denteado; estames soldados, com bases normais..*O. multiflorus.*

Obs. Esta chave é provisória, visto que as coleções do Gênero *Ochthocosmus* ainda são pouco satisfatórias.

1. *Ochthocosmus barrae* Hallier, Beihejte Bot. Centralbl. 39 pt. 2: 17. 1921. Tipo: Brasil. Amazonas: prope Barra. Prov. Rio Negro (Spruce 1802) Oct. 1851. (Foto do holótipo de B: VEN, isótipo NY). (Figura 3).

Árvore ou arbusto 2 — 19 m, ramo delgado. Folha obovada, limbo 5 — 9,5 X 2,5 cm, bordo crenado, nervura principal proeminente, as secundárias promínulas, ápice retuso, pecíolo 0,2 - 0,5 cm. Inflorescência ca. 6,5 cm de comprimento, panícula axilar, bráctea e bractéola 1 X 0,5 mm, sagitadas, glabras; flor ca. 6 cm X 3mm, cálice ca. 1 X 2 mm, persistente, sépalas 1 X 0,7 - 1 mm, 2 ovadas e 3 lanceoladas; corola ca. 4 X 5 mm. actinomorfa, pétalas ca. 4 X 1 mm, estames ca. 4mm, levemente soldados, bases dilatadas, anteras ca. 1mm, elípticas; ovário 3 - 5 locular, estilete ca. 3 mm, inteiro. Fruto cápsula loculicida, ovado, ca. 1 X 0,5 cm, sementes 2 por lóculo, aladas, 3 X 2 mm, achatadas, oblongas, ala membranácea, 4 - 5 X 2 mm, constituída por 2 folhetos superpostos.

Distribuição: Típica dos ambientes de mata de terra firme, cerrado e campina da Amazônia brasileira, principalmente do Estado do Amazonas, ocorrendo também no Pará, Mato Grosso e Rondônia. Separa-se geograficamente de *O. roraimae*, que é típica da Venezuela (detalhes em Steyermark & Luteyn 1980) (Figura 1).

MATERIAL EXAMINADO: BRASIL. Amazonas, Manaus, Ponta Negra, *Rodrigues* et al 10093, nov. 1978, fr. (MG); Manaus, Cachoeira Grande; *Ducke* 3, ago 1942, fr (MG); Manaus, Campo Amélia, *Teixeira et al* 1643, ago. 1985, fr. (MG). Pará, Itaituba, *Silva* 325, ago. 1979, fl. (MG); Rondônia, Vilhena, *Vieira et al* 834, nov. 1979, fr. (MG); Vilhena, *Santos et al* 855, mai. 1984, est. (MG).

2. *Ochthocosmus multiflorus* Ducke, Trop. Woods 50:33, 1937. Tipo: Brasil. Amazonas: Rio Curicuriary (afl. Rio Negro) Ducke 29033, 23 Fev. 1936, (holótipo RB, isótipos NY, US). (Figura 3E).

Arbusto 1 - 1,5 de altura, ramo delgado. Folha elíptica, limbo 5,5 - 7,5 X 2 cm, nervura principal proeminente, as secundárias promínulas na face ventral, ápice arredondado, pecíolo 1-2 mm. Inflorescência terminal ca. 4 cm de comprimento, bráctea 1 mm. filiforme, na base do pedicelo, glabra, flor ca. 8 mm, pedicelo 3 mm, glabro; cálice 1-2 X 2 mm, levemente soldado na base, sépalas 1-2 X 1 mm, lanceoladas, ápice denteado; corola ca. 4 X 4 mm, zigomorfa, pétala ca. 3 X 1-2 mm; estames gamostêmones, soldados na base, heterodínamos, 4-5 mm de comprimento, anteras ca. 0,8 mm, lanceoladas; ovário 5-locular, 1 mm, estilete 3 mm.

Distribuição: Ocorre nas savanas arenosas da Venezuela, Colômbia e do Brasil (Estado do Amazonas) (Figura 1).

MATERIAL EXAMINADO: VENEZUELA. T.F. Amazonas, Depto. Atabapo, *Huber & Tillet 5452*, jul, 1980, Bot. fl. (MG).

Roucheria Planch. *in* Hook Lond. Joun. Bot. VI:141 (1847). t 2.

Árvore ou arbusto, ramo glabro ou piloso. Folha elíptica ou oblonga, alterna, nervação paralela, dicotômica, nervura central proeminente, raro pilosa, nervuras secundá-

rias planas, bordo crenado ou serrilhado, ápice cuspidado ou caudado, base atenuada, pecíolo piloso ou glabro. Inflorescência axilar ou terminal, fasciculada ou paniculada, brácteas presentes; cálice pentâmero, zigomorfo, gamossépalo, persistente, sépalas ovadas, glabras ou pilosas nas margens; corola actinomorfa, pétalas lanceoladas, glabras ou com margens pilosas; estames 10, gamostêmones, heterodínamos, excertos, anteras sagitadas ou obovadas, rimosas, dorsifixas; ovário glabro ou piloso, 1 - 2 lóculos com 1 - 2 óvulos, 2 - 4 estiletes, estigmas labiados. Fruto drupáceo, elíptico ou ovado, anguloso ou não, 1 - 5 sementes, elípticos - angulosas, embrigão reto com endosperma.

Etimologia: em homenagem ao poeta Roucher, autor do Poema dos meses.

Espécie-tipo: *Roucheria calophylla* Planch.

De acordo com Hutchinson (1967), o gênero *Roucheria* apresenta 11 espécies na América do Sul. Esta afirmação precisará ser corrigida em uma revisão mais detalhada de *Roucheria*, já que algumas espécies foram sinonimizadas. Na Amazônia brasileira o gênero apresenta apenas três espécies. Na Colômbia temos *Roucheria elata* Ducke e *R. columbiana* Hallier, na Bolívia *R. boliviensis* Wink. e *R. laxiflora* H. Winkl., na Índia, *R. griffithiana* Planch. e na Venezuela, *R. angulata* Gleason.

CHAVE PARA AS ESPÉCIES DE *Roucheria*

1. Folha 10 - 31 cm de comprimento, base atenuada, limbo subcoriáceo a coriáceo; inflorescência panícula robusta, tipicamente terminal, sépalas com margens glabras, pétalas lanceoladas..*R. punctata.*

1. Folha 5 - 11 cm de compr., base aguda, limbo mais ou menos cartáceo; inflorescência em fascículo ou em panícula delicada, tipicamente axilar, sépalas com margens pilosas, pétalas não lanceoladas..2

2. Folha totalmente glabra; inflorescência em fascículo...................*R. calophylla*

2. Folha pilosa, principalmente no pecíolo e nervura principal (face dorsal); inflorescência em panícula delicada, raque bastante pilosa..............*R. schomburgkii*

1. Roucheria calophylla Planch., *in* Hook. Lond. Journ. Bot. VI (1847) 141. t. 2. Tipo: *in* Guiana Anglica, cl. Schomburgk, no. 988, 1840, in herb. Hook. (holótipo, K, foto do tipo MG). (Figura 4).

Hebepetalum parviflorum Ducke, Arch. Jard. Bot. Rio de Janeiro. 6:38. 1933; Bull. Mus. Hist. Nat. Paris. ser. 2;4:735. 1932. Tipo: Manaus (civ. Amazonas) 17.12.1929 leg. A. Ducke, H.J.B.R. no. 23.423 (holótipo RB, isótipo K, foto do tipo MG).

R. parviflora Ducke, Arq. Inst. Biol. Veg. Rio de Janeiro. 1:207, 1935; Tropical Woods, 43:21.1935.

Arbusto 2 - 5 m X 20 cm, ramo cilíndrico, piloso. Folha elíptica, oblonga ou lanceolada, limbo 6 - 11 X 2 - 3 cm, bordo serrilhado, ápice cuspidado, base aguda, pecíolo 0,3 - 0,5 cm de comprimento, glabro. Inflorescência axilar, fasciculada, 0,5 - 1 cm

de comprimento, brácteas ca. 2 mm de comprimento, lanceoladas, margens pilosas; cálice ca. 4 mm de comprimento, pequena soldadura na base, sépala 2 - 4 X 1 - 3 mm, 3 lanceoladas e 2 ovadas, pilosas nos bordos; pétalas 3 - 7 X 1 - 4 mm, superfícies grabras, margens pilosas; estames 1 - 5 mm de comprimento, soldadura em torno do ovário, antera ca. 0,5 mm de comprimento, livres, sagitadas; ovário ca. 2 X 1 mm glabro, 1 - 2 locular, 1 - 2 óvulos, placentação axial, estiletes 2 - 5. Fruto 6 - 7 X 4 - 5 mm, ovado-anguloso, sementes 1 - 5, 4,5 X 1,5 mm, elíptico-angulosas.

Distribuição: Parece ter distribuição restrita nas matas de terra firme, caatingas e nos igapós do Estado do Amazonas (Figura 7).

MATERIAL EXAMINADO: VENEZUELA. Rio Cassiquiarc, *S. Spruce* 3403, 1853-1854, bot (MG). BRASIl. Amazonas, Rio Marié, *L. Alencar* 489, jul. 1979. fr (MG); Rio Negro. *L.F. Coelho* 518, jun. 1976, fl (MG); Rio Negro *M.F. Silva et al.* 1663, mai. 1973, fl (MG); Rio Curicuriari, *L. Alencar* 593, jul. 1979, fr (MG); Rio Uaupés, *R.L. Fróes* 28218, abr. 1952, fl (IAN); Rio Tea, afl.Rio Negro, *L.R. Marinho* 496, jun. 1976, fr (IAN).

R. calophylla é próxima de *R. schomburgkii*, principalmente pela forma das folhas, o que pode confundi-las em uma análise rápida. Entretanto, *R. calophylla* se distingue facilmente por suas inflorescências tipicamente fasciculadas, apresentando também uma certa tendência do bordo foliar ser brevemente crenado, enquanto em *R. schomburgkii* o bordo é serrilhado.

2. *Roucheria schomburgkii* Planch., *in* Hook. Lond. Journ. Bot. VII (1848). Tipo: *in* Guiana Anglica, R.H. Schomburgk no. 1362 (holótipo K, foto do tipo MG). (Figura 5).

Hebepetalum schomburgkii (Planch.) Ducke, Arch. Jard. Bot. Rio de Janeiro. 6:38, 1933.

R. lineata Bth., nom. nud.

Árvore ou arbusto 8 - 20 X 0,5 - 1 m, ramo cilíndrico, glabro ou piloso. Folha elíptica ou oblonga, limbo 5 - 13,5 X 2 - 3 cm, nervura dorsal e áreas adjacentes pilosos, bordo serrilhado, ápice agudo ou cuspidado, pecíolo 3 - 5 mm, glabro ou piloso. Inflorescência axilar, panícula, ca. 1 cm de comprimento, pedúnculo piloso, bráctea ca. 1 mm de comprimento, sagitada, bordo e superfície externa pilosas, caducos ou não. Flor 2 - 5 mm de comprimento, pedicelo piloso; cálice ca. 2 X 1 mm, pequena soldadura na base, sépalas 1,5 - 2 X 1 mm, oblongas, bordos pilosos; pétalas 2 - 3 X 1 mm. margens pilosas; estames 3,5 - 4 mm, soldadura aderida à corola, anteras obovadas; ovário ca. 2 mm, subobovado, glabro ou piloso, uniloculado e uniovulado, placentação axial, estiletes 3 - 4, glabros. Fruto 0,5 - 2 cm de comprimento, ovado-anguloso, semente única.

Distribuição: Coletada nas matas de terra firme, caatingas e nos igapós do Pará e Acre. Também assinalada na Venezuela (rio Cassiquiare). Figura 7.

MATERIAL EXAMINADO: BRASIL, Pará, rio Maratauá, *A. Ducke* s.n., nov. 1922, fl (IAN); Mosqueiro, *E. Oliveira* 5593A, mar. 1971, fl (IAN); Mosqueiro, *J.M. Pires* e *N.T. Silva* 11275, nov. 1967, fl (IAN); Mosqueiro, *E. Oliveira* 5776, jul. 1971,

est. (IAN); Mosqueiro, *E. Oliveira* 5592A, mar. 1971, est. (IAN). Acre. Cruzeiro do Sul, *L.R. Marinho* 153, fev. 1976, fr (IAN); Cruzeiro do Sul, *O.P. Monteiro* e *C. Damião* 369, fev. 1976, fr. (MG).

Apesar do material botânico analisado estar pouco satisfatório para permitir uma boa avaliação de suas estruturas florais, *R. schomburgkii* deve ser mantida como espécie boa pelas suas folhas e disposição das inflorescências muito características, conforme se verifica na chave e na Figura 5.

3. *Roucheria punctata* (Ducke) Ducke, Arq. Inst. Biol. Veg. Rio de Janeiro, 1:207, 1935: Tropical Woods, 43:21. 1935. Figura 6.

Hebepetalum punctatum Ducke, Bull. Mus. Hist. Nat. Paris, ser, 2, 4:735, 1932; Archivos Jard. Bot. Rio de Janeiro, 6:38. 1933. Tipo: Manaus (civ. Amazonas), A. Ducke, flores coletadas em outubro 1929 (lectótipo RB no. 21.708; isolectótipo P, K; foto do lectótipo MG); frutos coletados em fevereiro de 1930. A. Ducke (parátipo RB).

Árvore 6 - 22 m X 8 - 20 cm, ramo cilíndrico, glabro, superfície irregular. Folha oblongo-lanceolada, limbo 10 - 31 X 4 - 9,5 cm, bordo serrilhado, ápice cuspidado ou caudado, pecíolo ca. 0,5 - 3 cm de comprimento, glabro. Inflorescência terminal, panícula 7,5 - 13,5 cm de comprimento, pedúnculo piloso, brácteas sagitadas. 0,3 - 4 X 1 mm, margens pilosas. Flor 6 - 8 mm de comprimento, cálice ca. 3 X 4 mm, pequena soldadura na base, sépalas 2 - 3 X 1 - 2 mm, 3 lanceoladas e 2 oblongas, glabras; pétalas 3 - 5 X 1 - 2 mm, glabras; estames 3 - 4 mm de comprimento; ovário uniloculado, uniovulado, placentação axial, estiletes 3 - 4 glabros. Fruto 1,5 - 1 mm, ovado-anguloso, sementes 1 - 2.

Obs.: A inflorescência é formada por várias flores em estágio jovem, cada uma protegida por uma bráctea. Dentro de cada bráctea encontra-se um material gelatinoso e hialino.

Distribuição: Espécie de ampla ocorrência nas matas de terra firme, caatingas e nos igapós, principalmente do Estado do Amazonas. Também ocorre no Pará, Amapá e Rondônia. (Figura 7).

MATERIAL EXAMINADO: BRASIL. Amapá, Macapá, Serra do Navio, *Mori & Cardoso* 17653, jan. 1985. fl (MG); Serra do Navio, *Rosa* 1107, out-dez. 1976, est (MG); Macapá. Cupixi. *Mori & Cardoso* 17704. jan. 1985, bot. (MG); Macapá, rodovia Perimetral Norte, *Rabelo et al.* 3119, dez. 1984, fl (MG); estrada Cupixi-Vila Nova, *Rabelo et al.* 3215, jan. 1985, fl (MG), Amazonas, rio Japurá, *Nascimento et al.* 156, abr. 1945, fr (MG); Rodovia Manaus-Porto Velho Km 245, *Prance* 20484, mar. 1974, fr (MG); Iarauetê, *Ribeiro* 958, mar. 1975, fr (MG); Carauari, *Lisboa* 1888, out, 1980, est (MG); Rodovia Manaus-Porto Velho Km 240, *Lleras et al.* P19606, nov. 1973, fr (MG); alto rio Negro. *Nilo T. Silva et al.* 60864, jan. 1966, fr (MG); Manaus, *Ducke* 1436, nov. 1943, fl (IAN); Taracuá, rio Uaupés, *Pires et al.* 7523, fev. 1959, est (IAN); São Felipe, alto rio Negro, *Baldwin, Jr.* 356, mar. 1944, est (IAN); Taracuá, rio Uaupés, *Pires et al.* 7524, fev. 1959, est (IAN); Pará, rio Jari, Planalto Monte Dourado, *Oliveira* 3974, jan. 1968, fl (IAN); Breves, *Pires et al.* 5960, jul. 1956, est (IAN); rio Jari, Monte Dourado, *Oliveira* 4060, fev. 1968, fr (IAN); Jari, Tinguelim Km 23. *Nilo T. Silva* 3168. mai. 1970, fr. (IAN); Breves, igarapé Arapijó, *Pires et al.* 5098, jul. 1956, est. (IAN). Rondônia, Santa Bárbara, rodovia BR-364 Km 120, *Teixeira* 810, mai. 1982, est (MG).

R. punctata é facilmente identificável entre as demais espécies do gênero pelas suas folhas grandes (limbo de 10 - 31 cm), de forma oblongo-lanceolada.

ESPÉCIE MAL CONHECIDA

Roucheria elata Ducke, Trop. woods 90:20. 1947. Tipo: Colômbia, Letícia, mata das terras altas, *Ducke 1799*, 3/11/45, fl (holótipo MG).

Árvore de ca. 30 m, coletada, ao que parece, apenas em Letícia, na Amazônia colombiana. Provavelmente pode ser encontrada no Estado do Amazonas, o que só um programa de coletas nas Áreas fronteiriças à localidade-tipo poderá revelar.

R. elata assemelha-se bastante com *R. schomburgkii*, o que fez com que os autores do presente trabalho relutassem em mantê-la como espécie válida. Ao que parece, *R. elata* diferencia-se, basicamente, de *R. schomburgkii* por apresentar as inflorescências mais ramificadas, escassamente pilosas (glabrescente ?) e folhas glabras. Acredita-se que a manutenção de *R. elata* como espécie boa está condicionada a uma análise de material botânico fértil (de *R. elata* e *R. schomburgkii*), em melhores condições do que as exsicatas aqui analisadas, a fim de que se proceda um diagnóstico comparativo seguro entre as duas espécies em foco.

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Ao CNPq, pela bolsa de iniciação científica (proc. no. 802.186/88-22) concedida à co-autora; aos Drs. G.T. Prance, A. Radcliffe-Smith e G. Ll. Lewis, do Royal Botanic Gardens Kew, pela gentileza de nos cederem fotos dos tipos e material bibliográfico, ao ex-estagiário Luís Eduardo Santos, pela dedicada colaboração no estudo das Linaceae, principalmente na elaboração de alguns desenhos; ao Dr. W. Overal pelo resumo em inglês; ao colega Rafael Alvarez, pelas ilustrações do hábito das espécies; à Dra. Léa Carreira, pela colaboração na parte de pólen. Um agradecimento especial à Dra. Graziela Barroso, que sugeriu esta pesquisa, e aos Profs. Jorge Fontella (Jardim Botânico, RJ), e Dan H. Nicolson (Smithsonian — U.S.A.), pela orientação em nomenclatura botânica.

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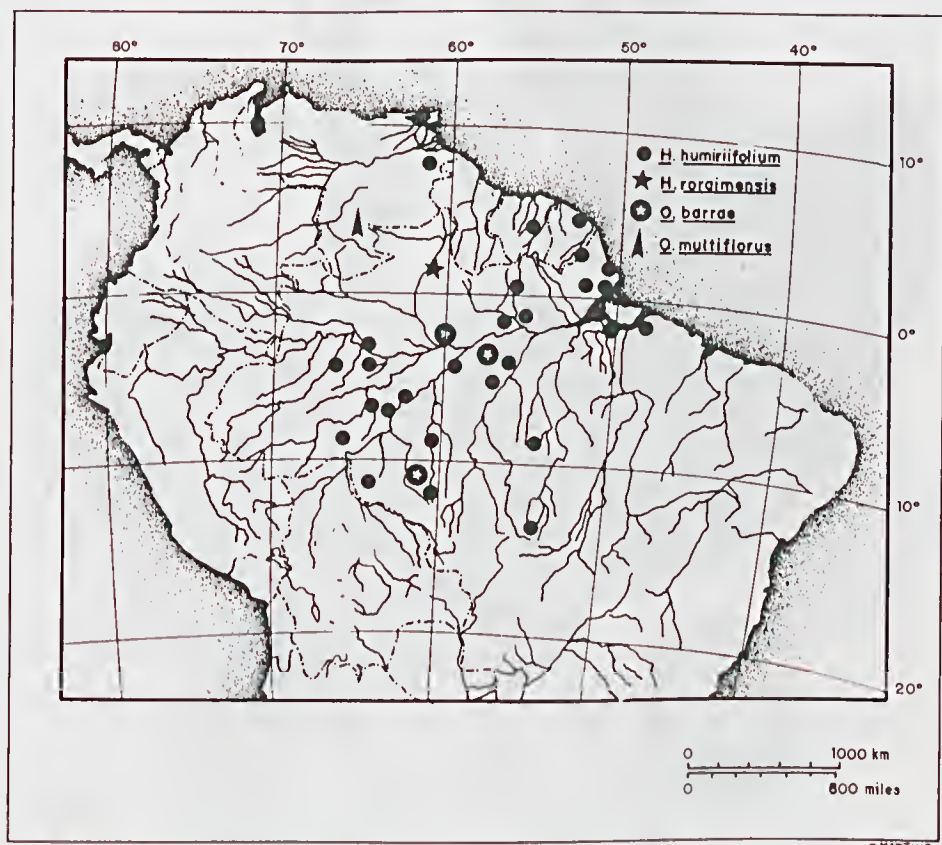


Figura 1 — Distribuição geográfica atual de *Hebepetalum humiriifolium*, *H. roraimensis*, *Ochthocosmus barrae* e *O. multiflorus*.

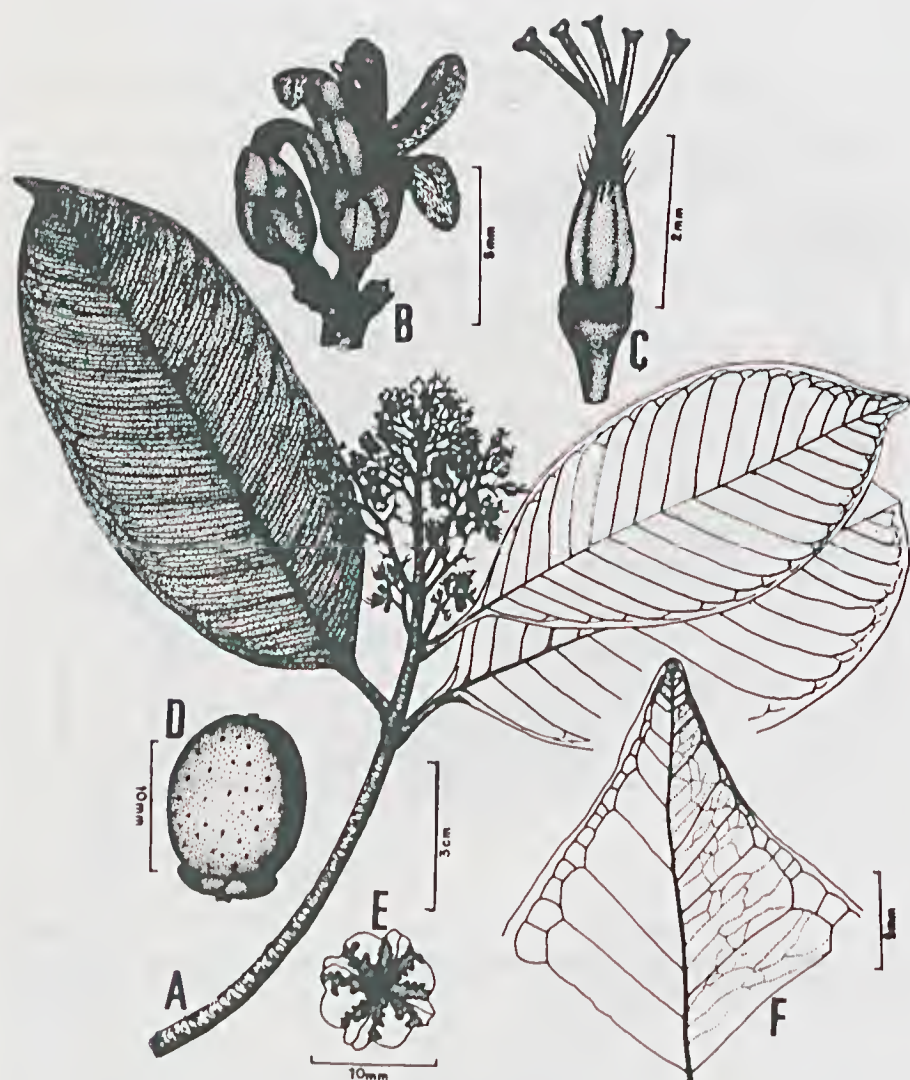



Figura 2 — *Hebepetalum humiriifolium* (Ducke 829, MG) A) Ramo fértil; B) Botão e flor, evidenciando pétala pilosa internamente; C) Gineceu; D) Fruto; E) Idem, parte interna lenhosa; F) Nervura foliar em detalhe.

Figura 3 — *Ochthocosmus barrae* (A.S.L. Silva 325, MG) A) Ramo fértil; B) Corte da flor evidenciando gineceu; C) Fruto (cápsula); D) Corte da semente. *O. multiflorus (O. Huber & S. Till et* 5452, MG); E) Ramo fértil.

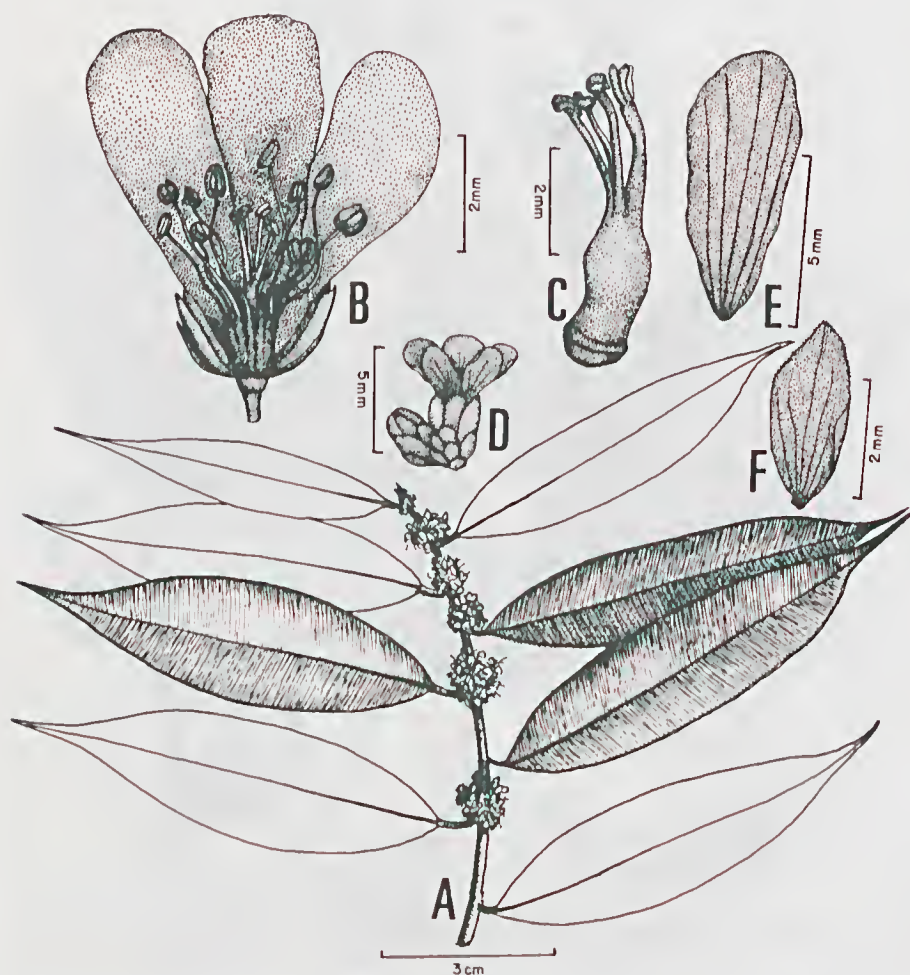



Figura 4 — *Roucheria colophylla* (*M.F. Silva et al. 1663*, MG), A) Ramo fértil; B) Corte de uma flor, evidenciando androceu e gineceu C) Gineceu; D) Botão e flor; E) Pétala; F) Sépala.

Figura 5 — Ramo de *Roucheria schomburgkii* (*L.R. Marinho 153*, MG) evidenciando o típico arranjo de inflorescências.

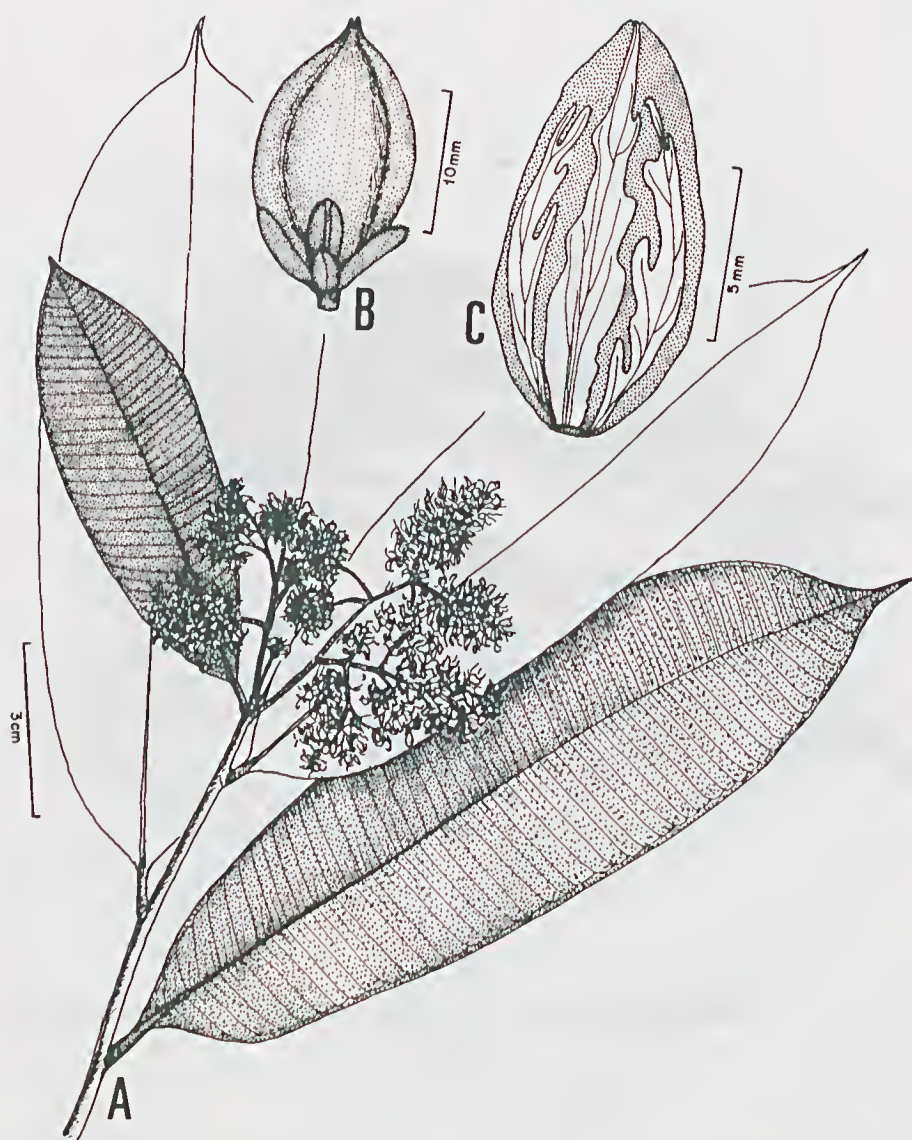
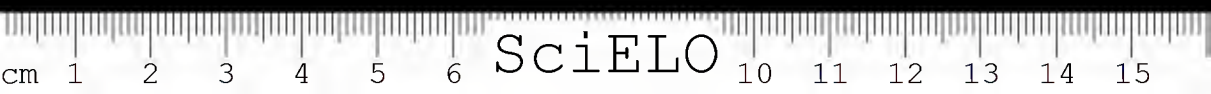



Figura 6 — *Roucheria punctata* (*S. Mori & Cardoso* 17653, MG) A) Ramo fértil; B) Fruto; C) Idem, parte interna.

Figura 7 — Distribuição geográfica atual de *Roucheria calophylla*, *R. punctata* e *R. schomburgkii*.

NOTA PRÉVIA SOBRE UMA GRAMINEAE NOVA DA SERRA DOS CARAJÁS, PARÁ

Maria de Nazaré do Carmo Bastos[1]

Realizando o estudo taxonômico das espécies de *Axonopus* Beauv. dos campos "rupestres" de Carajás, vegetação que habita a canga hematítica, encontramos uma espécie distinta das demais conhecidas. Após minuciosa pesquisa, chegamos à conclusão de que a mesma se enquadra na série Barbigeri G.A. Black, subsérie Barbigeri G.A. Black, pelas características apresentadas nas folhas e segunda gluma. As folhas são estreitas, involutas e a segunda gluma possui nervuras proeminentes e sulcos profundos.

De acordo com as características específicas, acreditamos que ela se posiciona próximo das espécies *A. barbigerus* (Kunth) Hitchc. e *A. siccus* (Nees) Kuhlman.

Apresentamos, a seguir, apenas as principais características desta espécie aguardando material botânico mais completo para oportunamente publicarmos a diagnose total do referido "taxon".

Axonopus carajasensis M.N. Bastos, sp. nov.

HOLOTYPUS: Brasil, Pará, Marabá, Serra dos Carajás, "N1", 25 Km NW of camp at Serra Norte. Aprox. 5°54'S, 50°27'W. Marshy area and nearby scrub on outcrop of ferrous rock, 13.XII.1981, *D.C.Daly, R. Callejas* et al. 1990. (MG)

Folia angusta, saepe involuta; nodo unico dense barbato; racemi plerumque 2-6; glumae 5-7 nervis, sulcatae, nervis proeminentibus.

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